Electrical World

The consolidation of Electrical World and Engineer and American Electrician.

Published by McGraw Publishing Company, Inc.

Vol. 65 NEW YORK, SATURDAY, FEBRUARY 27, 1915 No. 9

Opportunity to Aid the Electric Vehicle

WHILE central stations have done much in acquainting the public with the advantages of the electric vehicle and are themselves liberal purchasers and users of such machines, the manufacturers have not shirked their share of the burden. The greatest single investments made in electric vehicles, those by the department stores, breweries and express companies, were made at the behest of the manufacturers with little or no assistance from the lighting companies. However, instances abound where both have co-operated to mutual advantage. Such a situation now confronts the manufacturers of electric vehicles and in its solution the help of the central stations would be welcome and most valuable. As announced in our news pages, the Post Office Department is advertising for equipment to carry the mails and will consider motor vehicles in place of horse-drawn wagons for such service in many cities of the Middle West. The contracts are for four years, and if the central stations in the respective cities will see to it that the government gets what is best suited for the work and what is most economical, much of the mail in the Middle West after July will be carried in electric vehicles. As the time is short, intensive, enthusiastic co-operation is necessary or the opportunity will be lost. The cause is worthy of the best efforts of the central station.

The Panama-Pacific International Exposition

WITHOUT doubt the Panama-Pacific International Exposition, the gates of which have just been thrown open to the world, is worthy in every way of the greatest material achievement in American history, the completion of the Panama Canal. San Francisco may well be proud of the honor bestowed upon her and prouder still that she has brought to fruition so glorious a work, planned before the catastrophe that overtook her in 1906 and carried through despite that staggering handicap. Completed, like the canal, before time, the Exposition is remarkable in other respects as well. It contains no Palace of Electricity because the art cannot be thus confined—the whole Exposition is a tribute to electricity, for it is everywhere to be found. Outline lighting, which was characteristic of the expositions at Chicago, Buffalo and St. Louis, is nowhere to be seen, the architectural features, the statuary and the delicate buff and pastel colorings being brought out resplendent in all their beauty by means of masque and flood lighting. After sunset the view, in the estimation of many, when the palaces are flooded with light and the jeweled tower stands glittering and sparkling against the blackness of night, is a joy to behold, and better by far than the view by day. Many foreign nations are represented officially and by exhibits of private individuals, so that the fair cannot fail to promote foreign trade and foster international good will, a consummation devoutly to be wished in this year of grace. That it will stimulate American trade goes without saying; but if it serves no other purpose than acquainting the East with the West it will still be worth while.

An Analysis of Business Conditions

WHEN business is below normal it is expedient to examine underlying conditions closely and to take constructive steps for improvement. Enforced recession is a time of opportunity. Trade conditions gravely demand investigation—not governmental investigation, but the practical thought which only personal responsibility and knowledge developed by real contact with business problems can give. Although primarily concerning manufactures, the letters from Mr. Claude L. Matthews and Mr. Guy E. Tripp in this issue deal with our investment relations with Europe and hence touch an issue vital in future central-station financing. The point of leading importance is that business unrest began long before the European war. The war accentuated it. In analyzing causes one must logically take into account the profoundly adverse effect on business of governmental action in which the last three national administrations had a part. Signs here and there lead us to hope with some assurance that not only has the governmental attitude reached a climax but that as a menace to business it is now actually beginning to recede.

Treatment of Depreciation

THAT systematic provision for depreciation is made by some companies has long been known, and under improved accounting methods greater publicity is now being given the facts. In its annual report to stockholders for 1914 the Commonwealth Edison Company of Chicago explains its change in accounting practice. Depreciation reserve at the close of 1913 was $4,521,839, and there was set aside from the 1914 earnings for amortization and depreciation $2,215,147. The reserve stood at $6,600,596 at the close of 1914, indicating that during the year $136,390 was expended from this account. The mortgage required an allowance of $544,000 for depreciation reserve in the year, and this minimum provision for protection of the bondholders was materially and properly exceeded. The appropriation for the year is 11.6 per cent of the operating revenue. Ordinary operating expenses were 51.4 per

cent of operating revenue, the total for the two being 63.0 per cent. "Taxes and municipal compensation" absorbed an additional 7.8 per cent, making an aggregate for the three items of 70.8 per cent. Another feature of the change in the accounting practice of the company is that whereas the amount required by mortgage has been credited to depreciation reserve the estimated depreciation for the year has been credited annually in the past to plant accounts; as both are to be carried hereafter in the reserve, that account, barring large replacements and changes in the basis of earnings, will increase to substantially greater sums. Progressive central-station managers are learning that the necessity for depreciation accounts should be made clear to the public.

Conductivity of the Earth

From an electrical standpoint the earth is properly regarded as a great electric conductor. It not only offers a conducting surface for carrying the electric waves of radiotelegraphy, but it also provides a return conducting path for electric circuits of various kinds. Nevertheless, when an examination is made into the conductivity of the earth and its causes, it is found that nearly all of the substances composing the crust of the earth, such as granite, slate, chalk, clay or silica, are extremely poor conductors in the dry state. In fact, except for a few comparatively rare substances, the earth's surface material dried, at ordinary temperature, is virtually insulating. As to how the earth's substance may conduct at deeper and hotter levels, one can form only a rough guess, but the substances at the top owe their conductivity almost entirely to the water they contain, together with the saline substances dissolved in the water. Electric conductivity of the soil is its water conductivity.

A somewhat similar state of affairs is presented to our attention when we consider the thermal conductivity of the soil. The soil is indeed a poor thermal conductor in comparison with the metals, but an analysis of the nature of thermal conductivity in the soil shows that the solid substances when dried are virtually thermal insulators in nearly all cases, and that the water contained in the soil mainly accounts for the conductivity which is presented. To a considerable extent thermal conductivity of the soil is its water conductivity.

The last-mentioned relation was clearly brought out in a paper by Mr. L. E. Imlay, read at the recent midwinter convention of the American Institute of Electrical Engineers in New York City, on the effect of moisture in the ground on the temperature of underground cables. It was shown that the soil surrounding a buried conduit containing active electric cables may become hot, dry and powdery, a condition which would reduce its thermal conductivity to a minimum. The addition of moisture to the soil, either from above or from below through a vacant duct, brought about a very distinct reduction in the temperature of the cables, and also in the temperatures of the surrounding soil. It seems readily possible that future installations of heavily loaded conducting cables, buried in conduits, will have special water-cooling ducts laid in their immediate vicinity, for the purpose of keeping down the cable temperatures. A noteworthy result afforded by the observations of the author is the relatively great distances to which the heat liberated from active cables in a buried conduit can appreciably raise the temperature of the ground. It appears that the temperature of the soil 1 meter below the surface was raised by some 20 deg. C. at a distance of half a dozen meters away from the buried conduit.

Concentric Wiring

We are glad to see the open discussion that has been taking place regarding the possibilities of concentric wiring, and we hope that the subject will continue to be discussed frankly and freely from all possible viewpoints. On one feature all parties agree, namely, that there is a strong and growing demand for some cheap and effective system of wiring which will enable small consumers to be obtained in sufficient numbers to justify serving them. The isolated small consumer, who must perforce be classified with large consumers and dealt with accordingly, has always been regarded as a rather dubious asset to the central station. On the other hand, nothing is clearer from recent experience, both at home and abroad, than that when numerous enough to be dealt with as a class small consumers become profitable. We need not here enter into the details of handling the small-consumer business further than to note that if put on a contract basis the expense of carrying it is small, and if on a meter basis there is something to be said for less frequent billings than at present, in order greatly to reduce the bookkeeping and meter-reading cost.

In order to serve the small consumer effectively one must be able to wire his premises cheaply. The more outlets that can be provided for a given sum the more business on the whole the central station will obtain. It is an incontestable fact that the gradually increasing severity of the requirements of the fire underwriters has made wiring more expensive in spite of many improvements which have tended to lower the price of material. Concentric wiring provides a chance of reducing the installation costs in a way that should be very beneficial, but in order to succeed it must meet all of the reasonable requirements of electrical and mechanical safety. Suitable grounding can easily be obtained. A rascally inclined contractor or an utterly incompetent workman can make any system of wiring dangerous, but we believe that not only the character of the contractors but that of the workmen has steadily improved, and that these risks are becoming progressively less. Certainly it would not be difficult for a central station to make sure that its wiring campaign was properly carried out.

Possible mechanical difficulties which rise from the concentric construction and might make trouble in spite of careful workmanship deserve serious consideration. This matter has been referred to in our correspondence columns, and more information about it is highly de-

sirable. Experience abroad gives considerable encouragement, yet it is well known that one cannot in matters of construction rely implicitly on foreign experience. So far as the fire underwriters are concerned, they are apt to be ultra-cautious. It is safe to conclude that they will permit the concentric system to be used only after it has been cleared of all reasonable objections. We bespeak a thorough investigation and discussion of the whole matter. If concentric wiring should come into large use, it would undoubtedly work a revolution in the material now popular for interior wiring, and would work some inconvenience to makers of standard material. However, when the need is pressing the manufacturer must meet it, and if he can do so by any system which offers better protection than the concentric at a similar price he will reap his reward. At all events let the subject be opened up at once in theory and practice so that the real situation may be thoroughly understood by everyone concerned.

Calculation of Electromagnet Windings

It is characteristic of electrical engineers that they are addicted to dealing with wires. They are very apt to be engaged in thinking, designing, insulating, erecting, testing or operating wires. Even the engineers in so-called wireless telegraphy have a strong tendency in the same direction. In East India the unreflecting natives commonly associate all species of electrical workers under one and the same denomination of "tarwallahs," or wire-boys. This Oriental generalization may be sociologically indiscriminate, but it is not philosophically undiscerning.

In dealing with coils of wire for electrical engineering purposes, one might at first sight suppose that the geometrical and physical properties of a simple cylindrical coil, either with or without an iron core, were so fundamental and elementary that their quantitative relations were necessarily of the easiest sort. However, a little inquiry will sadly undeceive the verdant tyro. It is true that certain elementary geometrical relations, familiar to the ancient Greeks, present themselves in any examination of the subject, such as the proposition that the perimeter of a circle is π times its diameter. But any serious discussion of the resistance, inductance, magnetic or thermal behavior of a magnet winding of given dimensions will lead the student into any or all depths of mathematical complexity he may desire.

Not only are the quantitative relations of magnet windings complex in their details, but there is also a distinct element of variability in construction. When a bobbin is wound with insulated wire by a machine properly arranged for that purpose, the length of wire in the winding can ordinarily be predicted, after a few trials, to a nicety. Again, when the bobbin is wound by the hand of a skilled mechanic, the length of wire laid on can be predicted within a certain not very wide range. If, however, the bobbin is hand-wound by an unskilled winder, the discrepancy between the actual and computed length of wire laid on may be very great.

Many variables enter into the behavior and operation of an electromagnet winding. In some applications the cost of electric excitation, in others the cost of materials, in others the heating, in others the degree of magnetic excitation may be the salient considerations, and engineering formulas of a reasonably simple character have to be developed for each case as it arises. A relatively large literature already exists upon the general quantitative field.

In the article on page 529, by Messrs. E. E. George and Harold Pender, a set of working formulas is developed for determining the size of wire needed to yield a given number of ampere-turns, consistent with an assigned heating limit. The space-factor, or ratio of copper volume to winding volume, is assumed to be that pertaining to a perfect winding, without compression of the insulator and without settling between layers. It is shown that, in certain cases, equations present themselves of a higher order than the second and insist on being solved. In such cases graphical solutions are suggested in preference to arithmetical solutions. We think that this course will meet with the approval of the great majority of engineers.

In order to meet the requirements of the particular sizes of wire in the regular wire table, in cases where an intermediate size of wire would be indicated by computation, a suggestion is offered of employing a part of the winding of the next size larger and the rest of the winding of the next size smaller. This device is sometimes convenient, and the graphical solution relating to it is likely to be useful.

Calculated and Measured Corona Losses

Considering how recently high-tension corona effects and corona power losses have become known, it is surprising that the laws relating to the amount of these losses should have already been determined with so fair a degree of accuracy. In detail, no doubt, much room remains for elaboration, but the general laws have been worked out to a practically satisfactory degree of precision.

This condition of affairs is well illustrated by the paper read by Mr. F. W. Peek at the New York midwinter convention of the A. I. E. E., in which a comparison was presented between the calculated and observed corona power losses over various high-tension transmission lines. There are certain discrepancies which may be attributed to weather conditions or to variations in surface conditions of the conductors, but the general agreement shown is very interesting. The factors which enter into the production of corona loss are numerous. Among them are the temperature and pressure of the air, the size and shape of the wires, their surface condition and distance apart, the frequency and wave-shape of the applied emf, and the conditions of precipitation or moisture in the air, such as fog, dew or snow. With so many variables active it is indeed surprising that the observed results should already be in good apparent accordance with the theory.

LETTERS TO THE EDITOR

Opportunities for Electrical Manufacturers in Siberia

To the Editor of the ELECTRICAL WORLD:

SIR:—In his comments on "Opportunities for Electrical Manufacturers in Siberia," Mr. Chester W. Purington stated that "a reasonable way of shipping from America would be from San Francisco, or Portland, Ore., by direct lines to Vladivostock." In this connection attention should be called to the fact that two lines are running from Seattle to Vladivostock. The "Russian Volunteer Fleet," which is backed by the Russian government, had its first steamer here in November. It plans to have regular monthly sailings from Seattle directly to Vladivostock. The agents for this line are Messrs. Balfour, Guthrie & Company of Seattle. The steamers which have already sailed have carried full cargoes. The Royal Mail Steam Packet Line, the agents of which are Messrs. Frank Waterhouse & Company, has also established a service to Vladivostock with regular sailings. Both of these lines afford opportunities for direct shipments from this port to Vladivostock.

FRANK DABNEY,
Assistant Treasurer Puget Sound Traction, Light & Power Company.

Seattle, Wash.

Concentric Wiring

To the Editor of the ELECTRICAL WORLD:

SIR:—In the discussion of the proposed concentric-wiring system it would be unfair to assume that the statements on either side were inspired entirely by selfish motives. Aside from such interests, the advocates of the innovation have in view the advantages it would bring to some of our people from extension in the use of electric service, while those opposed to it fear the results of an untried system and the abandonment of standards of protection heretofore considered essential to safety of life and property. If the general adoption of this style of wiring were clearly and unmistakably an advance in electrical development, it would be useless for any individual or class of men to try to block the wheels of progress, as the attempt would be futile. But the very fact that there are so many and such persistent objections to it furnishes good ground for hesitation in its acceptance.

The requirements for safe electrical installations in the United States cannot be put on the same plane with those of England or Germany, where a system of wiring somewhat like the concentric is used, because of the much higher standard of general building construction and personal supervision with reference to fire prevention maintained in the latter countries. We are frequently reminded that our annual per capita fire loss is many times theirs. It was not so long ago that a favorite explanation for fires of uncertain origin was "crossed wires," but this is now rarely mentioned. The present high standard of electrical installation and protection has made the charge extremely improbable. A standard that has accomplished such results should not be hastily abandoned. It is difficult to see how a system of surface wiring like that proposed could be installed without offering a greater fire hazard from short-circuits due to accidental crushing and cutting of the exposed or semi-exposed conductor. There would also undoubtedly be a much greater tendency on the part of the consumer to make extensions in his own wiring because of the seeming simplicity of the system. This could hardly do otherwise than materially increase the risk from defective wiring and would be a matter difficult to control. The claim of economy in installation is, of course, the basis for believing that extensions would take place. In cities like Chicago, for example, where wood molding or knob-and-tube installations are no longer permitted, rigid conduit is principally used in new houses and armored cable in old.

Millions of feet of raceways exist in large office buildings, apartment buildings and factories which are as safe and permanent as the buildings themselves. The new system, even if cheaper, would scarcely be considered for this class of work. If the non-inclosed system of wiring was not considered satisfactory in smaller buildings in the residential districts, it is difficult to see how the proposed system would be. If not, its field would be confined to cities, towns and suburban sections where the requirements are less rigid. Here it would have to compete with the lower-cost systems, and the economy in its use would be open to question.

It is of interest to note that reports from England indicate that the corresponding system is not extensively used there, and that even some contractors, who presumably would favor it on account of the increase in the number of installations, do not do so.

It seems doubtful if the benefits claimed for the new system, even if realized, would not be secured at too great a cost, and while there is the present wide diagreement among competent judges it certainly would not seem wise, nor in accordance with precedent, to adopt a radical innovation regarding which there is so much honest doubt.

G. W. BORST,
Electrical Engineer, Chicago Fuse Manufacturing Company.

Chicago, Ill.

Thawing Sleet by Electricity

To the Editor of the ELECTRICAL WORLD:

SIR:—For a good many years the writer has believed that it is possible to thaw out any ice that accumulates on wires during a sleet storm, but it was only a few days ago that an opportunity presented itself to test the idea on our transmission line, which is 9 miles long and consists of three three-phase circuits of No. 4 B. & S. gage. After a sleet storm lasting ten hours, the outer diameter had increased to double that of the wires, but by passing 100 amp through each circuit for ten minutes, one after the other, all three circuits were made perfectly clear of ice. The above outline may contain some information of value to others who wish to try the experiment.

JOHN B. DORAIS,
Superintendent Canadian Electric Light Company.

Levis, Quebec, Can.

Weakness in Steel Towers

To the Editor of the ELECTRICAL WORLD:

SIR:—Referring to the letter of Mr. R. D. Coombs in your issue of Feb. 13 commenting on my letter in your issue of Jan. 23 on "Weakness in Steel Towers," allow me to state that the line I had in mind was one equipped with poles of the three-leg type and not fabricated structures. However, fabricated structures of both the pole and the tower type are being made of re-rolled material, and I believe it would be wise for purchaser and engineers always to satisfy themselves that the manufacturers of poles and towers are not using re-rolled material. The names of well-known manufacturers of structural shapes are rolled in the shapes, and hence where no name is visible the material employed should be traced to the stock from which it originated.

Franklin, Pa. B. HASKELL.

Mr. Tripp's Address on Business Conditions

To the Editor of the ELECTRICAL WORLD:

SIR:—Your report in your issue of Jan. 30, 1915, of the address made by Mr. Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, to the New England Street Railway Club in Boston on Jan. 21, has interested me greatly.

I agree heartily with him that "a most serious condition confronts us." However, after reading his remarks, I am in more of a quandary than ever as to the correct answers to the following questions:

(1) To what prosperous year or sequence of years in this country, since 1900, can Mr. Tripp point when money was not normal or plentiful in Europe, particularly in the Bank of France?

(2) To what years of business depression can Mr. Tripp point when the Bank of France was not extended or over-extended?

(3) Is it not a fact that, up to the outbreak of the European war in July and August, 1914, our security issues, which were offered by the large corporations to secure funds for the financing of betterments, improvements and new undertakings, were largely purchased by European investors? (It is said that they now hold about $5,000,000,000 worth.)

(4) Could this country have reached its tremendous industrial growth in the short space of 100 years without the aid of European capital?

(5) When *that* capital has been cut off more than it was in 1893, 1894, 1895 and 1896; 1902 and 1903; 1906 and 1907, and in 1910, 1911, 1912 and 1913, is not that the real cause of this unprecedented business depression?

(6) Is it not a generally recognized fact that the balance of trade was against us for four months of 1914 principally on account of the reduced buying power of the world due to the destruction of capital caused by the first and second Balkan wars in 1911, 1912 and 1913 and to the hoarding of capital in France and Germany because of the fear of a general European conflict?

(7) Is it not extremely advisable for us to begin to develop our foreign trade for manufactured products, so that the balance of trade can rarely, if ever, go against us, as England and Germany have done, or would Mr. Tripp advise us to build branch factories in foreign countries so that we do not need to seek foreign trade, except where these branch factories cannot get it?

(8) If it is advisable to have a balance of trade in favor of the United States, is it not advisable to make every legitimate effort to convince foreign buyers of the superiority of our products, and, if so, is there any time when we shall have a better opportunity than now?

(9) Secretary Redfield said in St. Louis on Jan. 22, 1915, to the foreign trade convention of the National Foreign Trade Council that thousands of tons of freight worth millions of dollars are accumulating storage charges in all of the ports of the United States for want of vessels to transport it; he read proof after proof of this; he said that the government had asked for suggestions, plans and remedies for this problem and still wants them, but up to then had not received even a suggestion. Is there any other way to obtain ships than that proposed in the ship purchase bill, in order to be in time, to take advantage of our opportunity?

(10) Is it not imperative, in view of the fact that the public service and larger industrial corporations have depended upon the purchase of a great part of their security issues by the investors of European countries, and that the great waste of capital is going on among the warring nations at the rate of $46,000,000 per diem, that we give serious consideration to ways and means for obtaining financial independence?

(11) Why would not Sections Nos. 80 to 84 of the companies' consolidated act of 1908 of England (which can be found in most law libraries) go a long way toward solving the problem? (In brief, this law is the fundamental reason why it is possible for promoters of new security issues to advertise a stock issue in the daily papers and state that the sale will take place on a certain day and then have the issue oversubscribed sometimes as much as five times on the day announced. It makes the promoters of new companies and stock issues lay all of the facts on the table for the prospective investors to see. It removes, as far as possible, the element of chance from the transaction. It states how much the promoters will get; what is to be done with the money; who are the promoters, the accountants, the bankers, the directors and the officers. Finally and most important of all, it makes each and every one of those who subscribe their names to the prospectus civilly and criminally liable for their statements.

(12) Is there any reason, except the reduction of brokers' and promoters' commissions, why a similar law in the United States would not go a long way toward enabling public service corporations and the larger industrial companies to finance their security issues in this country?

The answers to these questions by a man of the caliber of Mr. Tripp would be very interesting, and I hope that he and others will answer them for the benefit of the readers of the ELECTRICAL WORLD.

CLAUDE L. MATTHEWS,
Vice-president
W. N. Matthews & Brother, Inc.

St. Louis, Mo.

Mr. Tripp Expounds His Discussion

To the Editor of the ELECTRICAL WORLD:

SIR:—You have kindly handed to me a copy of the letter which Mr. Claude L. Matthews addressed to you with reference to the remarks recently made by me before the New England Street Railway Club in Boston.

The first five questions propounded by him ask for statistical data which would require more time to compile than I have available; but an examination of them leads to the conclusion that he believes the seasons of prosperity in the United States have coincided with the plentifulness of European money and its willingness to find investment in American enterprises and vice versa, and that as a nation we have been dependent for our good times and bad times upon the barometer of foreign capital as measured by the condition of the Bank of France. Whatever may have been the facts regarding the condition of the Bank of France during the several periods referred to in questions 1 and 2, it would be unsafe to base any judgment thereon as to the future, and I believe they should be regarded as having no more weight than many other interesting coincidences.

The financial relations between the United States and France have been much less intimate than those between the United States and England, but it is undoubtedly true that we have drawn largely upon Europe, particularly upon England, for the capital with which to finance our development in the past. In recent years, however, while we have continued to market securities abroad because of the favorable rates of interest ruling there, an increasing proportion of our financing has been done at home because we have now reached the stage where the annual savings of the United States available for investment are greater than those of any European country, and so well informed an economist as Sir George Paish, of London, estimates them as greater than the savings of England, Germany and France combined.

While the present inability to obtain foreign capital by reason of conditions in Europe is a handicap, it can

scarcely be considered the sole or principal cause of a business depression beginning long before the present war was entered upon and at least coincidental with the general agitation for legislative regulation of all business, the uncertainties in manufacturing industries due to prospective and actual tariff legislation, and the lack of earning power of railways.

Taking all things into consideration, it would be my opinion that the "real cause of this unprecedented business depression" is not the fact that European "capital has been cut off more than it was" in the years named by Mr. Matthews.

Mr. Matthews asks in question 6 if the balance of trade was not turned against us by reason of the Balkan wars and the hoarding of European capital in anticipation of the present conflict.

I should not think that these factors weighed heavily in the trade situation because the principal reason for the shifting of the balance was an increase of $133,000,000 in our imports from March 1 to Aug. 1, and the simplest way to account for that increase is the reduction in tariff duties. The effect of the increase in imports was accentuated by a decrease of $83,000,000 in exports, about 70 per cent of which occurred in manufactured articles.

The suggestion, in question 7, that it is "advisable for us to begin to develop our foreign trade for manufactured products," it seems to me, is not just to American manufacturers and exporters, in view of the fact that our exports of manufactures have increased more than 600 per cent in the last twenty years, or from $179,000,000 in 1893 to $1,185,000,000 in 1913, and that manufactures, which formed but 22 per cent of the exports in 1893, were 49 per cent of the greatly enlarged total in 1913. It is principally to manufactures that we owe our large export trade and heretofore favorable balance of exports over imports.

Manufactures exported showed an actual gain of $1,006,000,000 from 1893 to 1913, while the increase in all other merchandise in that period was but $591,000,000; in fact, the percentage of growth in American manufactures exported was larger than the percentage of growth in British or German exports of manufactures in the period 1900 to 1912.

To those who have indorsed the popular fallacy that American manufacturers are not skilful and energetic in their business I recommend an investigation of these statistics, which I believe to be accurate.

The eighth question asks "if we shall have any better opportunity than now to convince foreign buyers of the superiority of our products." We should, of course, improve every practical opportunity to convince foreign buyers of the good quality of American manufactures; and, in view of the facts already noted, it would appear that we have been quite successful in doing so.

Whether a time of general financial depression and absence of purchasing power in many countries and communities is an especially favorable one for an attempt to establish new trading relations each manufacturer and exporter will determine for himself.

The latest information regarding trade conditions the world over indicates that the volume and value of international commerce at present is but about two-thirds of normal.

Question 9 asks: "Is there any other way to obtain ships than that proposed in the ship-purchase bill in order to be in time to take advantage of our opportunity?" Doubtless there has been a congestion of certain freights at certain ports of the United States, though this congestion, as shown by the statements published by the Secretary of the Treasury, occurs chiefly in wheat and cotton. The congestion in wheat will soon be relieved by reason of the fact that our surplus is being rapidly exhausted, while that in other freights will be reduced by the fact that many ships which were delayed in European ports by lack of labor and docking facilities for the discharge of their cargoes are now being rapidly unloaded and released for further activities in the carrying trade. While a temporary lack of carrying facilities was an inevitable consequence of the destruction or tying up of ships by the war, there seems to be at Washington a difference of opinion as to whether this should be relieved at the expense of the taxpayers or left to private enterprise. Many believe that the only way in which the government can increase the supply of ships more promptly than private capital can do it would be by purchase of the interned vessels at our ports, and that such a step by the government might result in grave international complications. Even these interned ships would have been purchased before this by private capital and added to the ocean fleets if encouraging laws had been enacted and there had been no international obstacles.

Question 10, which asks if it is not "imperative that we obtain financial independence of Europe," may be answered emphatically in the affirmative; and it may also be added that such degree of financial independence as we have already achieved has been accomplished by developing our home resources, building up our independent industries and protecting our home market.

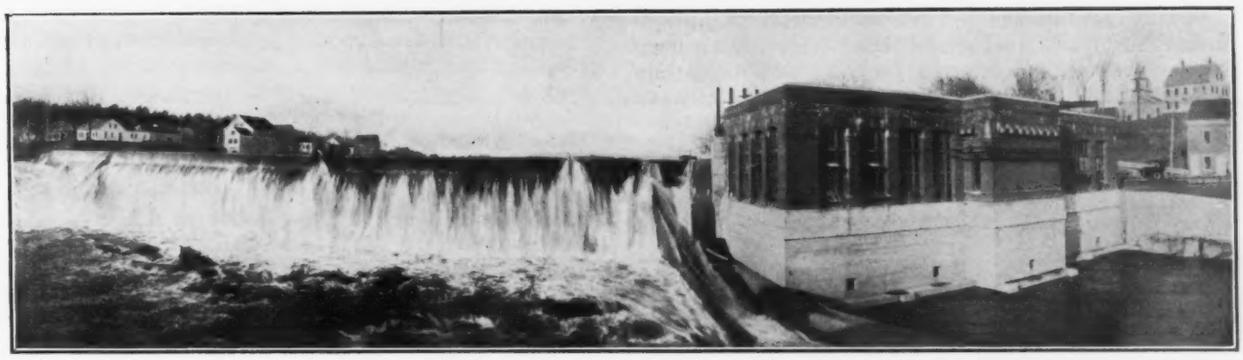
The magnitude of our home market can scarcely be realized until we compare it with the foreign markets of which we hear so much. The value of the domestic merchandise, the products of our farms and factories and forests and mines sold in the home market annually is practically twice as great as the value of all such articles forming the international trade of the world in a like period. Moreover, the value of domestic manufactures sold in our home markets is more than twice the value of all the manufactures exported by all the countries in the world, and I repeat what I said in Boston, that the removal of any measure of encouragement and protection of home industries on the theory that the injury will be repaired by any increase in foreign trade that we are likely permanently to retain in competition with England and Germany is a colossal mistake.

That some degree of protection has been removed seems to me indisputably shown by an increase of $133,000,000 in imports between March 1 and Aug. 1, which, it should be remembered, was a period of depression.

The suggestion, in inquiry 11, that something similar to the English companies act (which provides for great publicity about security issues) become a law is an excellent one, and I believe that financial authorities in this country would very generally approve of provisions of this character by which the promoters or brokers offering the securities of a new company would be required to set forth publicly all of the material facts relative thereto and be held accountable for their truthfulness. As a matter of fact, this was practically the conclusion reached by the Hadley commission appointed several years ago by President Taft and which found no place, so far as I have been able to observe, in the various anti-trust laws which have been enacted recently.

I have already trespassed too greatly upon your space, but I feel that in so far as practical it is due to Mr. Matthews (who has certainly raised many interesting questions) that I should express my views, not as a political economist, however, which I am far from claiming to be, but merely from the viewpoint of a business man having an earnest desire to contribute whatever I am able toward the exposition of sound business principles.

New York. G. E. TRIPP.



Central-Station Development at Portland, Maine

Engineering and Operating Features of Large Interconnected System—The Hydroelectric Plants at Bonny Eagle, West Buxton and North Gorham

THE electric-service system of the Cumberland County Power & Light Company, of Portland, Maine, represents one of the most important recent examples of centralized energy production and distribution to be found in New England. The policy of consolidation of properties has been carried out along unusually broad lines in the southern part of Maine by the banking houses of A. B. Leach & Company, New York City, J. & W. Seligman, New York City, and E. W. Clark & Company, Philadelphia, and the expansion of the present system from the limits of only a few years ago is of much interest. With an outstanding capitalization of $9,770,000, the company owns three hydroelectric plants within 25 miles of Portland and a steam plant in the latter city, and it controls through lease the Portland Railroad Company and through stock ownership the Lewiston, Augusta & Waterville Street Railway and the York County Power Company. The company does the entire street-railway, lighting and motor-service business in Portland, and controls the electric-railway systems connecting the most important nearby cities, with the exception of the recently completed Portland-Lewiston Interurban Railroad.

In addition to the control of electric railways in Yarmouth, Bath, Lewiston, Auburn, Gardiner, Augusta and Waterville, the company controls the electric-lighting and motor-service business of Biddeford, Saco and many other places along the York County coast, including Old

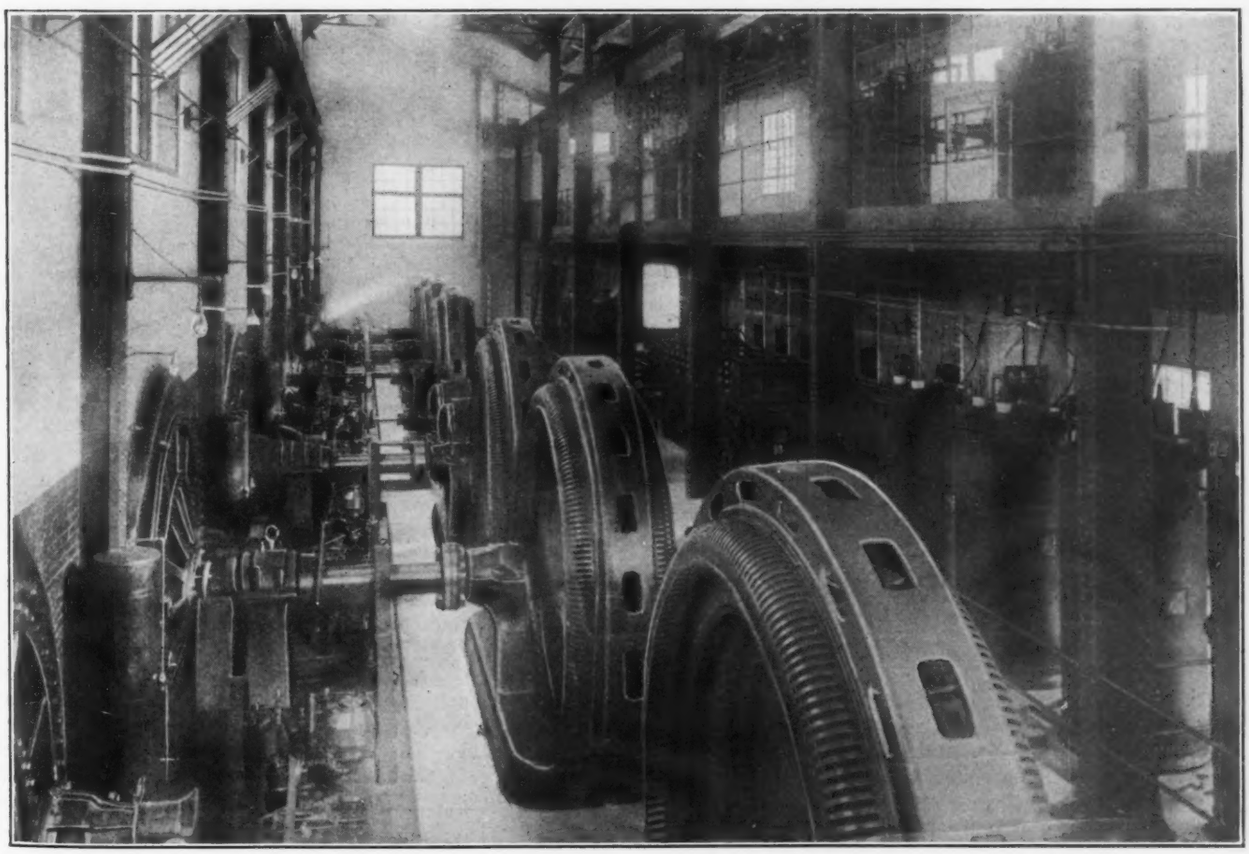


FIG. 1—GENERATING ROOM AT BONNY EAGLE STATION

Orchard, Kennebunk and Waterboro, Sanford, Springvale, Alfred, York Harbor and Beach. The Cumberland company owns a hydroelectric plant of 12,000-hp rating at Bonny Eagle, on the Saco River, a 4021-hp station on the Saco River at West Buxton, and a third hydroelectric plant of 2547-hp rating at North Gorham, on the Presumpscott River. These stations are connected with

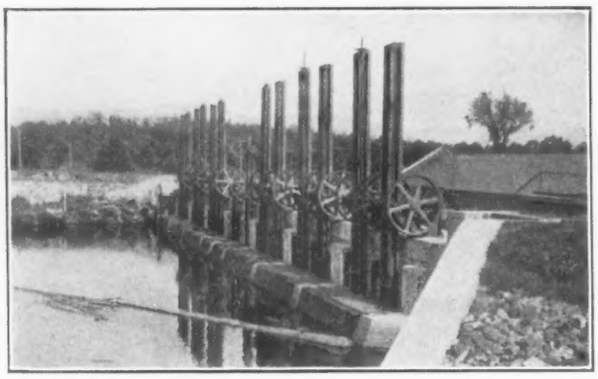


FIG. 2—HEADGATES AT BONNY EAGLE PLANT

Portland by two 38,000-volt transmission lines running from each plant to the so-called Sewall Street substation, which is the most important distributing point on the system. A tie line also connects the North Gorham and Bonny Eagle plants, so that the high-tension system forms a complete loop which is of great value in operation.

At Biddeford the York County company owns a 2500-hp steam plant, and there are available small stations for emergency use at Kennebunkport, Sanford and York Harbor. The Portland Railroad Company, operating 107 miles of track, furnishes street-railway service in Portland and the suburban district lying between Saco and Yarmouth. The Lewiston, Augusta & Waterville Street Railway does not purchase energy from the Cumberland system, as the lines of the Central Maine Power Company and the Androscoggin Electric Company are within its territory and are more accessible. The Portland Railroad Company has a steam plant of 6099 hp on the waterside of the city, the Lewiston line has 1720 hp in steam plants, and there is also available at Plum Street, Portland, for auxiliary and emer-

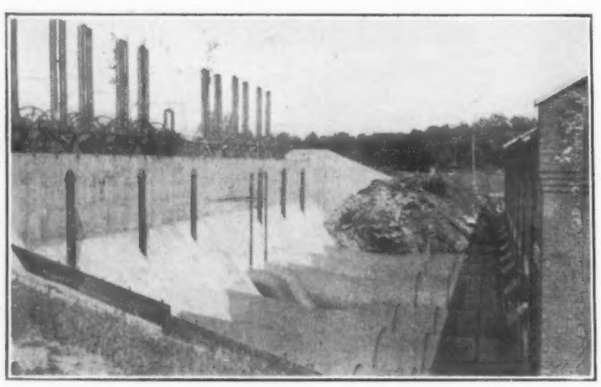


FIG. 3—DAM, PENSTOCKS AND WHEELS AT BONNY EAGLE PLANT

gency service a 3310-hp steam station. The total generating rating of all the steam and hydroelectric stations under the company's control is now 33,497 hp, and the estimated population served is 200,000. The gross earnings of the company for 1913 were $2,354,797, operating expenses and taxes were $1,215,247, and net earnings $1,139,550. The balance available for dividends, sinking funds and renewals was $327,650, a full 6 per cent dividend on the preferred stock requiring $138,000. The annual output of the Cumberland County company's plants alone is now about 38,570,000 kw-hr., there having been a gain of 11,000,000 kw-hr. in the past year. Portland is the largest city and commercial metropolis of Maine. It is the terminus of three railroads and several transatlantic and coastwise steamer lines and has diversified manufactures.

The Saco River has a total fall of 1880 ft. in 104 miles, the maximum rate of fall being 94.6 ft. per mile near its source in the lake district of the Crawford Notch. The total drainage area is 1750 sq. miles. The plants at Bonny Eagle and West Buxton are among the

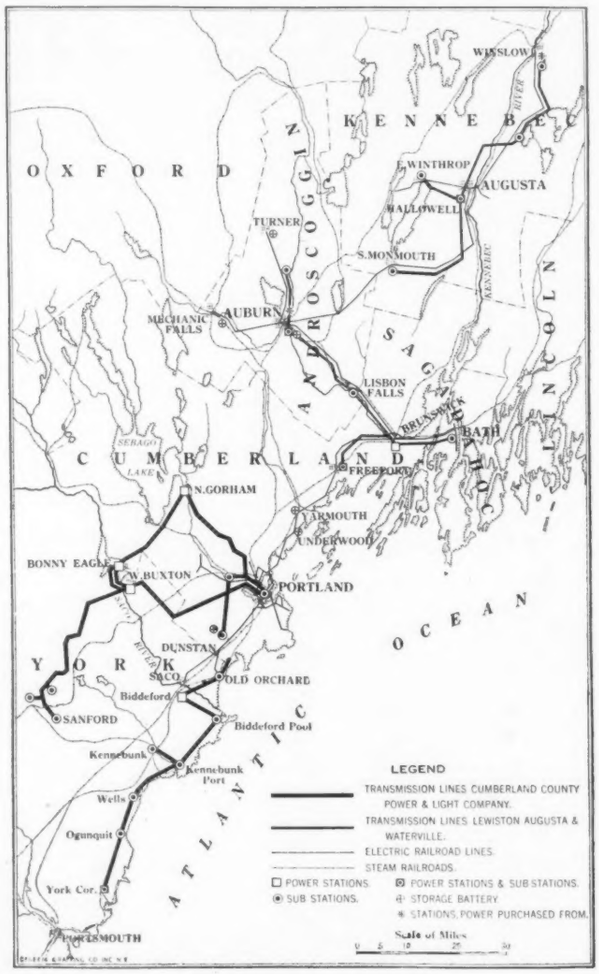


FIG. 4—TRANSMISSION SYSTEMS OF CUMBERLAND COUNTY POWER & LIGHT COMPANY

most modern in Maine from the standpoint of hydraulic design, the former being the more recently completed station. Service was begun at Bonny Eagle in the spring of 1912. The plant was designed by J. G. White & Company, Inc., New York, and its electrical features are as satisfactory as its hydraulic characteristics.

Bonny Eagle Plant

The Bonny Eagle development is situated 19 miles from the outlet of the river. Above the plant in the Saco watershed are 33 sq. miles of lakes and ponds. The run-off of the river averaged 1.31 cu. ft. per second per square mile in 1911, and 1.61 cu. ft. per second per square mile in 1910. The station, a concrete, brick and steel building with a steel truss roof, 160 ft. by 50 ft., spans a narrow gorge. The main dam, a solid concrete structure 160 ft. long, 50 ft. high and 8 ft. wide at the

top, is erected immediately above the station. About one-quarter mile above the station a diverting dam with a 400-ft. spillway has been built across the river channel, so that a forebay about 0.9 sq. mile in area is established above the headworks. From the main dam six steel penstocks 13 ft. in diameter lead to the wheels, and two 4.5-ft. penstocks lead to the exciter wheels. The head on the wheels averages 39 ft., and the company is able to use 4 ft. of flashboards on the dam. There are six generating units in the station, each being a 1500-kva, 2300-volt, three-phase, sixty-cycle alternator directly driven on a horizontal shaft by a 51-in. S. Morgan Smith turbine with Lombard governor. Two gates are provided for each large penstock and one for each exciter penstock. Reinforced-concrete draft tubes take the discharge from the wheel casings to the tailrace. Each wheel has three bearings, two being inside the wheel casing and the third inside the generator room, which is separated from the wheel proper by a brick wall. From each main penstock a 12-in. relief pipe is carried upward vertically to above the intake level, smaller pipes being used in connection with the exciter penstocks. Inclined screens are provided on the upstream side of each pair of headgates, and the gates

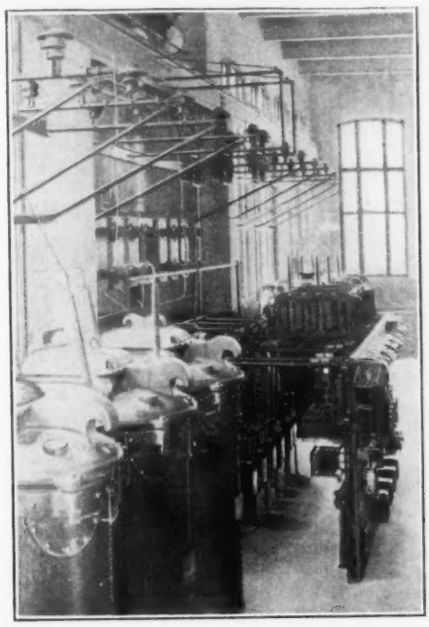


FIG. 5—SWITCHBOARD AND TRANSFORMERS, WEST BUXTON STATION

are operated by hand through gearing. The pond immediately above the station can be drawn down to a minimum of 24 ft. below high water in operation. A reinforced-concrete log sluice with a gradient of 0.3125 ft. per ft. leads from the dam through the power house to the tailrace. The sluice is V-shaped, with an inside width varying from 6 ft. at the top to 1 ft. at the bottom. It is reinforced by nine 60-lb. steel rails the bases of which form a wearing surface against which the logs run in their downward passage. The sluice is 8 in. thick on each side of the runway at the top and about 8 ft. wide at the bottom.

The station arrangement is simple and efficient, all the generators being mounted on concrete foundations in a single row with two 125-kw, 125-volt exciters in the center, each directly driven by a 21-in. S. Morgan Smith turbine. The switchboard is installed on the generator-room floor. The east side of the station is divided into bays by the columns and is double-decked, the operating-room floor carrying low-tension oil switches, 2300-volt buses, and three banks of step-up transformers, each of the latter consisting of three 1000-kva water-cooled units which raise the pressure to 38,000 volts. At the rear of the bays under the gallery are installed sets of electrolytic lightning arresters connected with horn-gap dischargers mounted on a channel-iron frame outside the building, a narrow footwalk

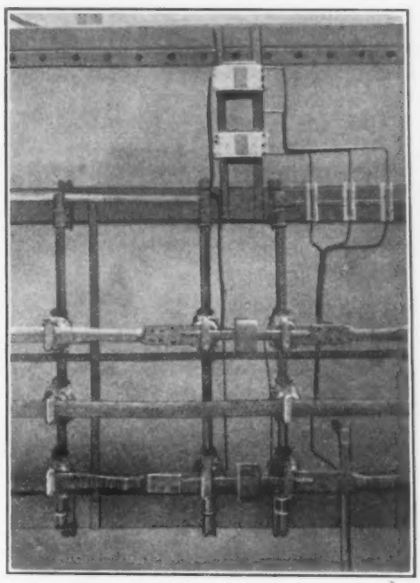


FIG. 6—2300-VOLT BUSBARS AND AUXILIARY CONNECTIONS

being provided close to the latter to facilitate inspection and repairs. Inclined bushings carry the taps through the wall. On the gallery, which is built with a concrete floor reinforced by I-beams 16 ft. above the main floor, are installed the high-tension oil switches, disconnecting switches and buses associated with the outgoing lines.

The low-tension side of the station is laid out for one set of 2300-volt buses sectionalized into three parts, one pair of generators being connected with one bus section by leads run in fiber duct laid in the floor. The exciter leads are run in galvaduct. Disconnecting switches are installed on each side of every oil switch. Low-tension oil switches are of the solenoid-operated type, with tripping relays in concrete compartments on the main

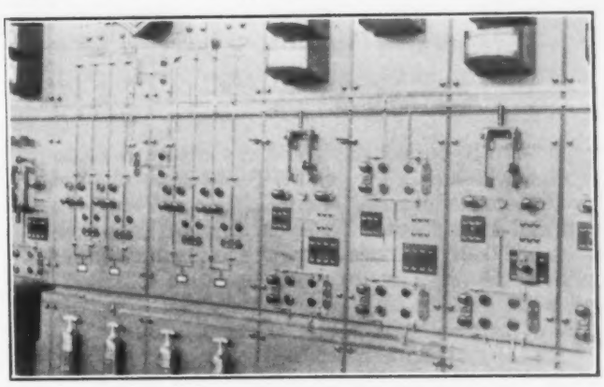


FIG. 7—SECTION OF SWITCHBOARD

floor, the disconnectors being mounted between barriers of asbestos board.

The lightning arresters have an auxiliary ground on the waterwheel casings. The conductors from the 2300-volt generators are lead-covered cables run vertically through a concrete recess in the bus structure to the buses, the series transformers being mounted in the cables about 4 ft. above the floor, with leads run in con-

duit to the switchboard, and with potential leads for voltmeter and wattmeter coils taken off at the top through fuses and conduit, the arrangement being unusually good mechanically and straightforward electrically. Each switchboard panel is provided with a concrete compartment at the rear to localize trouble.

The operating room is lighted by fourteen 150-watt lamps suspended from 1-in. pipe brackets attached to the columns and carrying the lamps 18 in. from the wall and about 15 ft. above the floor. The bus structure is built to accommodate two sets of three-phase, 2300-volt buses in case the company desires to install them later. All oil switches are remote-controlled from the switchboard, and energy for solenoid operation is supplied by a 55-cell "chloride" battery mounted in a fireproof compartment off the gallery. The battery is charged by a 5-kw motor-generator set mounted on the generator-room floor. The inside wall of the battery room is of "Hy-rib" concrete construction.

The high-tension leads are run upward vertically from the transformer bushings through openings in the gallery floor. The leads are of copper tubing and are supported on horizontal insulators attached to a pipe framing which also serves as a guard against approaching the conductors too closely. The gallery is 15 ft. high and is laid out with space for two sets of three-phase, 38,000-volt buses, with sectionalizing and tie switches, although only one set has been installed. The buses are divided into two sections, and the outgoing lines, after passing through choke coils mounted near the roof, pass through inclined wall bushings and are tapped into the outside circuits, the latter being dead-ended on strain insulators mounted against the wall panels below the eaves. The electrical equipment of the station is in the main of General Electric make.

The West Buxton station is situated about 2 miles south of Bonny Eagle. The average discharge of the river at the former point in 1913 was 3174 cu. ft. per second, and the maximum was 15,800 cu. ft. per second. Operating under a normal head of 25 ft. at this plant are four 750-kw, 2300-volt General Electric generators, each directly connected to a 48-in. S. Morgan Smith turbine. The plant was designed by J. G. White & Company, Inc., and is a 101-ft. by 50-ft. structure of concrete and steel, with brick curtain walls, flanking a concrete dam 300 ft. long which provides the necessary head for the turbines. The penstocks are short tubes leading from a screened forebay to the wheel casings, and the usual draft tubes are provided. Two 70-kw exciters directly driven by waterwheels are installed between the main units. Three governors are of the Replogle type, the fourth being a Lombard equipment.

On the down-stream side of the generator room are installed the switchboard, oil-switch cells and step-up transformers. Two banks of transformers, each consisting of three 500-kw units, are installed on either side of the switchboard. One set of 2300-volt buses is provided, and the 38,000-volt buses are divided into two sections with disconnecting switches between. The outgoing lines are carried through 18-in. vitrified pipe with a 90-deg. bend in each case to keep out moisture, and on the station side of the pipe a double thickness of window glass is also provided.

The North Gorham plant, which is situated at Great Falls, on the Presumpscot River, contains four 500-kw, 10,000-volt, three-phase General Electric generators directly driven by 33-in. Stilwell-Bierce & Smith-Vaile waterwheels operating under a head of 40 ft. The station is a one-story brick building connected with the water supply by steel penstocks carried up-stream to the further side of a stone masonry and crib dam 35 ft. high. Two and one-half miles above the station is Sebago Lake, which furnishes the water supply of Portland. The lake and its tributaries have a drainage area of about 470 square miles and the daily discharge at the lake outlet is about 925 cu. ft. per second. Each generator is equipped with a 30-kw belted exciter. Three 500-kw step-up transformers are installed at North Gorham, in a separate building, to raise the voltage for transmission to Portland.

A subsequent issue of the ELECTRICAL WORLD will contain a description of the company's substations and transmission system, with references to its commercial practice and electrical-appliance shop.

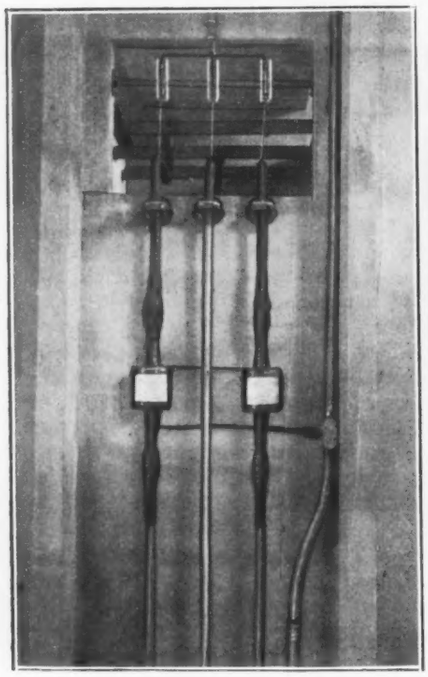


FIG. 8—SERIES TRANSFORMERS AND CONNECTIONS WITH BUSBARS

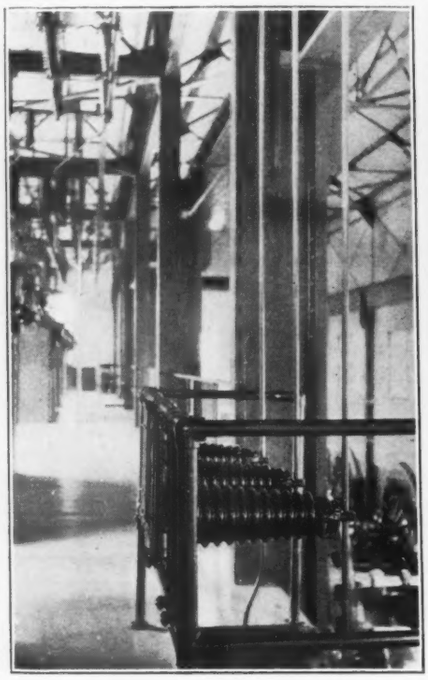


FIG. 9—38,000-VOLT LEADS FROM TRANSFORMERS

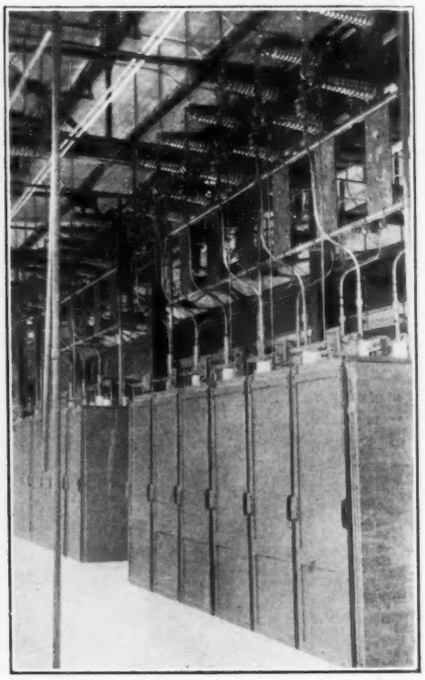


FIG. 10—OIL SWITCHES AND DISCONNECTING SWITCHES

Midwinter Convention of the A. I. E. E.

Abstracts of Papers Which Were Presented at the New York Meeting and of the Discussions That Took Place Upon Them

IN our last week's issue a brief outline was given of the midwinter convention in New York City of the American Institute of Electrical Engineers, an account of the symposium on "The Status of the Engineer" and abstracts of papers entitled "Dimmers for Tungsten Lamps," by Mr. F. E. Waller, and "Distortion of Alternating-Current Wave-Forms Caused by Cyclic Variation of Resistance," of which Messrs. Frederick Bedell and E. C. Mayer were joint authors. In this issue are given abstracts of additional papers and the discussions thereon.

Adaptability of Motor to Different Classes of Work

Mr. D. B. Rushmore presented a paper entitled "The Characteristics of Electric Motors Involved in Their Applications," in which he pointed out that the characteristics of a motor should be determined by the class of work it is intended to perform. Data were given showing the enormous increase in the application of electric motors for driving industrial machinery since the year 1899.

Among the subjects treated in the paper were the advantages of electric motor drive, applications, classification, rating, limitations, speed classification, characteristic curves, mechanical considerations and operating features.

Attention was called to the fact that commutation affects the life of brushes and commutators considerably with continuous-duty motors, but with intermittently loaded machines sparking may be permitted if the commutator and brushes have time to polish between "peaks." When a motor is geared or directly connected to a machine the speed of which must be changed periodically, sparking will always occur on the same segments of the commutator, therefore sparkless commutation should be maintained on all loads. Regulation is an important factor on paper machines, cutting tools, etc. The efficiency is usually an important feature of continuously running machines; of secondary importance on cycle-duty apparatus, and of little account where a motor runs practically all the time on armature control. Power-factors affect only the cost of supplying energy to the motor.

In selecting motors their characteristic curves should be studied to determine whether they will conform with the load conditions. It is also important to know the condition existing at the place where the motor will be installed, in order to ascertain the proper kind of installation to use. From an operating point of view it is also necessary to know the following: Stability of operation, effect of voltage, frequency and wave-form variation, effect of unbalancing phase voltages, effect of single-phase operation on three-phase circuits, limitations to throwing motors directly on line, etc. It may also be advisable for motors to have a small flywheel effect and characteristics which will improve the power-factor.

Discussion

The subjects outlined in Mr. Rushmore's paper were treated in detail in written discussions by Messrs. L. E. Lanier, K. A. Pauly, Ernst F. W. Alexanderson, C. J. Fechheimer, F. B. Crosby, A. E. Averrett, Lee F. Adams and C. A. Adams. These reports in general represented a compilation of information which would be valuable in a handbook on motor characteristics and applications. Mr. Lanier exhibited characteristic curves of various kinds of direct-current motors, and pointed out that the relative dimensions of armatures have considerable effect on the inertia even when the volume is not changed. Mr. Pauly showed that flywheels are effective in smoothing out power curves of motors carrying fluctuating loads the peaks of which occur frequently but only for a short period. He pointed out that automatic regulators can be employed to maintain constant speed as the energy in the rotating flywheel is given up. Mr. Alexanderson showed characteristic curves of railway motors and various types of alternating-current machines. Mr. Fechheimer called attention to the improvements made in synchronous motors by providing them with squirrel-cage windings which assist in starting and prevent hunting. Another improvement which was cited is the permanent connection, both electrical and mechanical, of exciters to their respective motor shafts. Characteristic curves were shown to indicate the effect these changes have had on the machines. The speaker declared that induction motors are superior to synchronous motors on loads up to 75 hp. Mr. Crosby commented on the characteristics of multi-speed changeable-pole and concatenated motors, saying that they are only a compromise between the ordinary alternating-current motor and the shunt-wound direct-current motor. He described a method of controlling the speed of induction motors which permits the return to the line of energy generated in the secondary circuit. Mr. Averrett discussed the characteristics of variable-speed combinations, and explained the effect which changes in voltages, frequency, wave-form, etc., have on the characteristics of these motors. Mr. L. F. Adams' talk related to journal, ball and roller bearings and lubrication. Prof. C. A. Adams spoke of the effect which magnetic saturation and leakage will have on commutation. He also pointed out that motors operated in concatenation will not have the characteristics which they have when operated separately.

Cooling Underground Cables

The method employed by the Niagara Falls Power Company for cooling its underground cables was described in a paper entitled "Effect of Moisture in the Earth on Temperature of Underground Cables," by Mr. L. E. Imlay. The scheme first employed was to circulate water through one of the vacant ducts adjacent to the occupied ducts. Later porous drain tiles were installed parallel to and above the cable ducts so that water flowing through the tile could percolate through the ground surrounding the cable and finally be carried away through agricultural tile drains installed below the ducts. The approximate temperatures of the cables were ascertained by inserting resistance thermometers in ducts adjacent to the cables which were supposed to be the source of heat. The temperature of the cable insulation next to the conductor was determined from these readings by referring to a chart based on a formula given by Messrs. Atkinson and Fisher in a paper presented before the A. I. E. E. in 1913.

Discussion

Mr. H. W. Fisher submitted a written discussion in which was described a method of ascertaining earth temperatures without introducing errors due to convec-

tion and heat carried away by the thermometer tube. It was pointed out that earth temperatures are affected by the character of the surface and the condition of the atmosphere—whether cloudy or clear.

Mr. W. S. Clark said that cables belonging to the

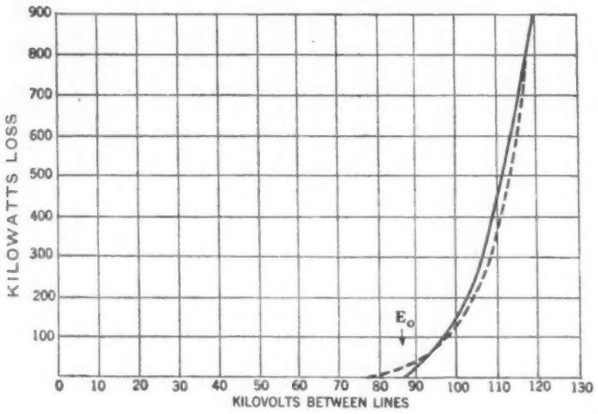


FIG. 1—63.5-MILE THREE-PHASE LINE OF WEATHERED NO. 0 CABLE SPACED 124 IN.

Commonwealth Edison Company and installed under the Chicago River were for a time cooled by pumping water through the tunnel. He also referred to an installation in St. Louis where the clay surrounding the ducts was baked like brick dust apparently because of the lack of moisture to conduct away the heat. Mr. Philip Torchio said that temperature is of secondary consideration with pressures up to 2200 volts. For higher voltages the dielectric strength of the insulation is considerably affected by heat. He referred to one company which is installing its cables in separate ducts to improve the radiation of heat.

Prof. W. S. Franklin called attention to an electrical method which has been developed by the Department of Agriculture for measuring the thermal conductivity of the earth.

Mr. P. W. Sothman pointed out that the radiation

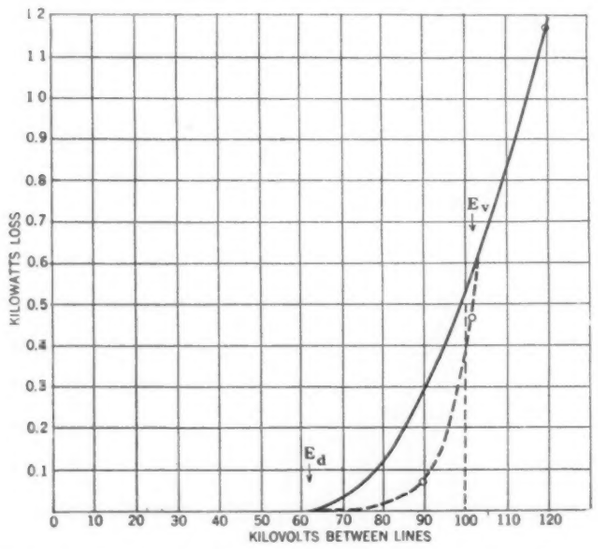


FIG. 2—SINGLE-PHASE LINE WITH SMOOTH NO. 8 CONDUCTORS SPACED 145 IN.

from porous tile should be greater than that from glazed tile according to theory, and added that it would be a good subject to study.

Mr. George N. Lemmon called attention to a cable failure at Youngstown, Ohio, caused apparently by the high thermal resistivity of the surrounding earth. Among others who took part in the discussion were Messrs. J. P. Wintringham and C. A. Adams.

Oil Circuit-Breakers

A brief explanation of some of the arc phenomena occurring when oil circuit-breakers are opened, a description of the construction of modern oil circuit-breakers, and a method of rating and preparing specifications for this apparatus, were given in a paper entitled "Oil Circuit-Breakers," by Mr. K. C. Randall. In general, the rate of contact separation should be proportional to the frequency of the system when endeavoring to attain the ideal condition of terminating current at the end of the first half cycle. The extinguishment of the arc, however, will take place near the normal zero point regardless of the speed of opening. Some switches have been so designed that the oil will be agitated when the contacts are separated, thus introducing clean, fresh, cool oil between the electrodes. Producing a large number of breaks in series simultaneously will have the same effect as opening a single break more rapidly. Oil will deteriorate more rapidly in a slow-operating breaker than in one where the same amount of energy is dissipated prior to the first zero value. The ability to deionize arc gases will depend on the temperature and pressure of the surrounding oil, the shape and volume of the contacts, and also on the heat conductivity and vaporizing temperature. Fast closing like fast opening is important, as an explosion is likely to take place when the arcing tips of a slow-closing breaker touch during a short-circuit. Probably the maximum power rating for plain breakers as now built will approximate the power that would be delivered through a shunt-tripped breaker at the time of opening by high-reactance generators having a combined rating of 150,000 kva and feeding energy to a maximum short-circuit from a single bus. It was pointed out that a circuit-breaker designed for instantaneous tripping can be rated at only half the value that it would be if a time delay of about 0.8 second were introduced. The best method of specifying breaker equipment is to indicate the maximum current which will have to be interrupted as well as the service voltage. An engineer was quoted as saying that a breaker is satisfactory for a given voltage if the unit may be immediately put back into permanent satisfactory operation without immediate repair.

In a discussion of this paper the following took part: Messrs. W. S. Franklin, Philip Torchio, H. R. Summerhayes and P. M. Lincoln. Mr. Summerhayes declared that it would be practically impossible to increase the pressure in tanks artificially to extinguish arcs more quickly, as abnormal pressures are produced when current-carrying contacts are separated.

Mr. Lincoln said that a considerable saving in material and reduction in heat loss is made by using reactance instead of resistance. Mr. Randall declared that a reactor connected in series with the switch would have to be much larger than one shunted across auxiliary contacts in series with the main contacts.

Corona Loss

In a paper entitled "Comparison of Calculated and Measured Corona-Loss Curves," by Mr. F. W. Peek, Jr., were shown several curves indicating by means of dotted and heavy lines the relation between the actual and the calculated corona losses. These curves represent conditions which have existed on lines in various parts of the country, at altitudes ranging from sea level to 10,000 ft. Theoretically, if the conductors were perfectly smooth, no loss should occur until the visual critical voltage is reached, when the loss should take a definite value. Above this value the loss should increase

as the square of the difference between the applied voltage and disruptive critical voltage. Owing to dirt and other irregularities on the surfaces of the conductors, however, brush discharges usually occur at voltages below the critical value. It was found with large weathered conductors where the disruptive and visual critical values approached each other that the loss followed the quadratic law very closely. On the other hand, with new conductors and especially small ones the loss at voltages lower than the visual critical value falls below the quadratic value. In general, the disruptive critical voltage should be the limit of pressure on practical lines, as otherwise storms will cause excessive losses.

Discussion

Prof. J. B. Whitehead expressed the belief that corona loss takes place gradually instead of assuming a definite value at the visual corona point as stated by Mr. Peek. He suggested allowing the factor of safety to take care of irregularities in the surface of conductors.

In addition to answering questions brought out in the discussion, Mr. Peek declared that small irregularities on the surface of small conductors have more effect than on large conductors. He also said that the potential gradient required to produce corona discharge increases considerably when conductors are brought close together.

100,000-Volt Portable Substation

A 4000-kva portable substation belonging to the Southern Power Company and designed to operate on 100,000 volts was described in a paper entitled "A 100,000-Volt Portable Substation," by Messrs. C. I. Burkholder and Nicholas Stahl. As about 70 per cent of this company's 100,000-volt circuits are paralleled by railroads, the portable substation has become very useful in supplying temporary service in many places on the system. Besides serving as a reserve equipment for larger stations, the portable substation may be used to replace distributing or tie-in substations while they are being enlarged or rebuilt. The equipment may also serve for break-down replacement, emergency stand-by service, pioneer service (pending a determination of the proper location or equipment for the permanent substation) or to supply energy to those who need it immediately.

The equipment includes three transformers, three high-voltage horn-gap switches and two inclosed cabs arranged alternately along the deck of a flat car. The horn-gap switches are supported near their respective transformers on a steel framework. The switch bases slide vertically between the main columns supporting the framework so that the horn-gap insulators can be lowered while the portable substation is being transferred from one place to another. The horn-gaps and transformer-terminal bushings may be removed during transit.

Oil-insulated, self-cooled transformers are employed, but additional cooling is provided by a motor-driven blower capable of supplying 20,000 cu. ft. of air per minute at 1 ounce pressure. The air passes to ducts around the base of each transformer and thence up along corrugations. The quantity of air supplied can be regulated by shields at the transformer base. When the transformers' terminals are removed they are supported on steel racks inside the cabs and the ends inclosed by sheet-steel cylinders which prevent the moisture entering the condenser-type bushings.

The transformers are so designed that it is possible to obtain 168 different ratios of transformation, 112 of these combinations being secured without reducing the permissible output rating of the transformers. Voltages ranging from 13,200 volts to 100,000 volts may be applied to the high-tension windings, and the low-tension windings may be connected for pressures from 2200 volts up to 13,200 volts. Small lead-covered conductors are also brought out of the low-tension side of each transformer from separate single-phase windings designed for 10-kva output at 110 volts. In this way the

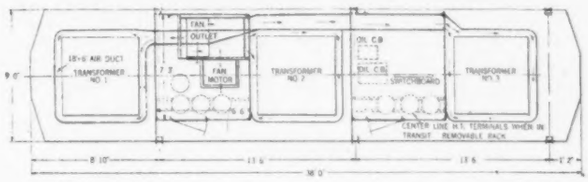


FIG. 3—SUBSTATION PLAN

correct voltage may always be obtained for operating the blower motors, lighting the car and operating auxiliary equipment regardless of what the high-tension or low-tension voltages of the main windings may be.

The high-tension terminals are connected in delta by joining adjacent transformer terminals to the nearest switch terminal and connecting the first and third transformers by a wire supported on insulators which lean outward from the steel frame. The low-tension conductors, which consist of lead-covered cable, lead inside the switch cab, where they are connected in delta with two sets of switches feeding energy to the outgoing line through porcelain bushings set in the rear wall of the switch cab. Indicating and recording meters are installed on a switchboard inside one of the cabs. In order that one set of instruments may be employed with any low-tension voltage, they are connected with the outgoing circuit through two sets of series transformers operated from pallet switches fastened to the oil switches. When one of the oil switches is opened the corresponding series transformers are short-circuited and the other transformers are connected to the measuring instruments. The total weight of the installation including the cars is approximately 135,000 lb. and the cost of the equipment complete and ready to run was approximately $21,000, or $7 per rated kva. Notwithstanding the conflicting requirements imposed upon the portable substation and the various functions it is called upon to perform, the test of experience has demonstrated the adequacy of the design and the satisfactoriness of operation.

Discussion

Mr. Julian C. Smith expressed the belief that a three-phase transformer is better than three single-phase transformers as it is more compact and can be sup-

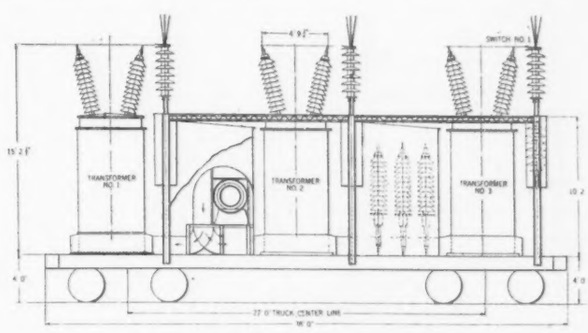


FIG. 4—SUBSTATION ELEVATION

ported on a depressed platform to allow sufficient overhead clearance.

In closing the discussion, which was participated in by Mr. K. C. Randall and Mr. L. W. Chubb, Mr. Stahl said that conditions did not permit installing lightning

arresters on the portable substation, and that the Southern Power Company uses single-phase transformers exclusively. For protection against lightning the company depends on the equipment in the nearest generating substation. In answer to Mr. Chubb's question the speaker replied that it was not necessary to inclose totally the transformer corrugations to insure good ventilation as the air hugs the casings in any event. Other reasons for not confining the cooling air are that larger passageways are afforded and larger output is permitted when operating without the blower.

Distortion of Alternating-Current Waves

Following the presentation of the paper entitled "Distortion of Alternating-Current Wave-Forms Caused by Cyclic Variation in Resistance," which was abstracted in last week's issue of the ELECTRICAL WORLD, the following took part in the discussion: Dr. Clayton H. Sharp and Messrs. J. B. Taylor, C. Field-Frank and L. W. Chubb. Dr. Sharp called attention to the fact that under uniform conditions the temperature of an incandescent body will not vary appreciably if the frequency of the alternating current is high. He also pointed out that the power-factor of a tungsten lamp circuit is very high even when third and fifth harmonics are present and that variations in voltage cause a resistance change which lags behind the change in voltage. Mr. Taylor said that the difference in power-factor with tungsten-filament and carbon-filament lamps is not reason enough alone to advocate one system being used more than another. He also called attention to the cyclic changes in transmitter circuits where the current follows the resistance change, and in wireless telephone circuits where alternating-current energy is employed. Mr. Field-Frank declared that there is a large resistance hysteresis in wireless circuits. Mr. Chubb expressed the belief that other harmonics besides the third can exist in a circuit containing only resistance. If other harmonics are present, the fundamental wave will not necessarily be shifted as much as indicated by the authors.

Dimmers for Tungsten Lamps

The next paper, entitled "Dimmers for Tungsten Lamps," was abstracted in last week's issue of the ELECTRICAL WORLD.

Discussion

The following took part in the discussion: Messrs. Leonard Kebler, C. D. Knight, J. B. Taylor, W. S. Franklin and H. Ward Leonard. Mr. Kebler presented a written discussion describing the mechanical construction of dimmers and methods of insuring good contact and free turning. Mr. Knight advocated employing more steps and adjusting the total resistance to that of five times the lamps controlled to give the proper dimming. Professor Franklin declared that it is not necessary to have the same resistance between each step and recommended grading the resistance so that each change would produce the same apparent variation in illumination. This can be done, the speaker declared, by comparing the intensity of lamps in two separate circuits. Enough resistance can be inserted in one circuit each time to bring the filament intensity below that of the comparison lamp. Mr. Leonard spoke of the construction of early forms of lamp dimmers and compared them with the compact rheostats now employed. He expressed the belief that dimmers should be so designed that each rheostat unit will require the maximum permissible number of watts when it is operating at its maximum duty.

In closing the discussion, Mr. Waller stated that Professor Franklin's method of determining the required resistance, which had been tried, is not satisfactory as the variations cannot be noted when gazing at brilliant filaments. He declared that much better results can be obtained by reflecting light from the lamps to a background and comparing the illuminated surfaces.

Searchlamps

Some of the essential and desirable features of searchlamps, methods of testing reflectors and results of tests conducted on 36-in. and 60-in. navy searchlamps and the Beck vapor-cooled 44-in. lamp were outlined in a paper, "Searchlights," by Mr. C. S. McDowell. Constructional features and performance characteristics of the latter were described on page 181 of the ELECTRICAL WORLD, issue of July 25, 1914. Mr. McDowell pointed out that searchlamp drums should be so made that air currents cannot be set up inside, otherwise flickering of the arc will occur; the ventilation should be sufficient so that the light can be kept at full intensity with the shutters closed, or else other means should be adopted for keeping the light at low intensities, prior to opening the shutter. It is also essential that a ground-glass finder be provided to show the position and length of the arc as well as the movement of the positive crater away from the focus of the mirror. Resistors of fixed and variable resistance should be connected in series with the searchlamp electrodes, the first to overcome the natural instability of the carbon arc and the second to allow accurate adjustment of the pressure between the electrodes. The voltage drop across the fixed resistance should be at least one-half that across the arc.

In order that a reflector may serve its purpose most effectively, the majority of the light to be projected should fall on it, thus fixing the relation between the focal length and the diameter of the mirror. The correct focal length is that which, changed in either direction, decreases the foot-candle illumination on a distant object. By increasing the focal length the arc can be placed farther from the mirror, thereby decreasing the chance of breakage by heat. Descriptions were given of the line or screen test, the sun or zone test, and the beam photometric test for determining the efficiencies of searchlamp mirrors. The first test consists of placing a screen in front of the mirror and photographing its image with a camera placed back of a hole in the center of the screen. If both surfaces of the mirror are properly ground, the lines in the photograph should be regular but not necessarily straight or parallel. The ability of a mirror to reflect incident parallel rays at a common point can be determined by placing the mirror in a plane perpendicular to the sun's rays and photographing the converging rays, which may be brought out by producing a cloud of smoke in front of the mirror. One of the most reliable tests for a mirror is to place a light at its focus and measure the actual foot-candles of illumination produced at different points in the beam.

Searchlamp arcs should have the following characteristics: Small positive electrode with high-current densities and high temperatures throughout the crater area; small negative electrode, long arc and uniform mixture of carbon. It was pointed out that if the diameter of the light source be cut in half while the candle-power remains constant, the intensity of illumination on the target will be quadrupled. Long arcs were advocated as negative electrodes sometimes cut off the most intense rays emitted by the positive crater. The shadow produced by the negative electrodes can, of course, be further decreased by reducing its diameter. The arc length is restricted by the stability of burning.

It was shown that the candle-power measured at 40 deg. from the normal to the arc surface using standard navy carbon electrodes increases as they are separated until the arc length is about 13/16 in., after which the candle-power does not increase considerably with the

separation of the electrodes. With the same electrodes it was found that the best operating pressure to maintain across the arc was from 59 volts to 61 volts. The length of the arc corresponding to these pressures averaged 21/32 in., or a little less than the length giving the highest candle-power at 40 deg. from the normal. Because of the shorter wave-length present in the light from the Beck lamp, this lamp is particularly useful in naval service where bluish-gray ships must be distinguished. It was also found that the Beck searchlamp produced about 13 ft.-candles at the center of the beam, 2850 ft. from the light source, as compared with 5 ft.-candles produced by the 60-in. navy standard searchlamp.

Discussion

Mr. E. H. Martindale presented a discussion prepared by Mr. R. B. Chillas, Jr., on improvements in searchlamp electrodes. Mr. Chillas pointed out that the wandering of the arc is affected by the texture of the negative electrode. He declared that a tapered tip can be maintained on small carbon electrodes by copper-plating them. Reference was also made to a three-change-gear mechanism which permits a 10 per cent variation in feeding either the positive or the negative electrode. By reducing the diameter of electrodes a 30 per cent increase in flux falling on the mirror has been obtained and the arc has been stabilized.

Dr. Karl G. Frank declared that if a certain current density is exceeded a corresponding increase in the efficiency and intrinsic brilliancy will not be obtained. Other subjects referred to were the melting point of carbon, the absorption of light by the atmosphere, and the possibility of clearing the atmosphere by high-tension electrical discharge.

Mr. H. A. Hornor pointed out that searchlamps should be as simple as possible as they cannot receive the attention on merchant vessels that they do in the navy. Mr. R. Fleming said that oxidation takes place around the positive tip more than at the crater as the latter is protected by inert gases. He suggested making the mirrors to correspond with the light sources instead of employing parabolic mirrors which are designed for point sources only. Professor Franklin declared that it is impossible to correct the shape of mirrors so that they will give parallel rays with larger than point light sources. Dr. Sharp declared that absolutely parallel rays are not desired with searchlamps because the surface illuminated would then be only as large as the diameter of the mirror. He pointed out that the brilliancy of the crater represents the temperature of vaporization of carbon, and hence an increase in current will merely increase the size of the crater and not the intensity. Moreover, the bright lines in the gas at the crater are not necessarily a sign of higher temperatures, but rather of luminescence.

In closing the discussion, Mr. McDowell said that improvements have been noted by employing small electrodes. He declared that a minute change in the position of the arc will change the beam intensity as much as 50 per cent. To show that the intensity of the Beck searchlamp depends almost entirely on the arc, and to a lesser extent on the mirror, the speaker said that tests show that the mirrors used are less efficient than those on other searchlamps. He pointed out that too much dispersion is objectionable as some of the illumination is wasted when projecting over long distances.

Electrical Precipitation

The session on Friday morning was devoted exclusively to a discussion on electrical precipitation. Before any papers were presented Dr. F. G. Cottrell gave a brief outline of the history of electrical precipitation. He explained that the precipitation of localized suspended matter had been investigated more than had the removal of fog, as the first is supported by individuals, and also because it was the most logical method of attacking the problem. As some steamship companies have expressed their willingness to pay the cost of investigating the precipitation of fog, undoubtedly considerable work will be done along this line in the future.

Following the historical review, three papers were presented in succession.

In a paper entitled "Electrical Precipitation," by Mr. W. W. Strong, it was pointed out that the energy required to precipitate smoke or dust can be calculated from the formula $E = \frac{1.2\pi\mu a l^2 d V^2}{L}$, in which E will be obtained in ergs per second when μ is the coefficient of viscosity of the medium, a is the radius of a suspended particle, l is the distance between the walls of the precipitation chamber, d is the density of the particles, V is the longitudinal velocity of the gas and L is the length of the precipitation chambers in centimeters. This formula shows that the greatest efficiency is obtained when l and d are as small as is practicable. In general, l should not exceed 5 in. or 6 in. and V should not greatly exceed 8 ft. or 10 ft. per second. Electrical precipitation seems to require the action of as uniform and dense a corona as possible upon the gas containing the suspended matter. High temperatures usually permit a large corona current density. Break-down between electrodes should be prevented as fluctuations in ionization of the gases may cause considerable trouble. About 10 per cent of the energy of the corona discharge is used directly in precipitating smoke. A formula was derived for the corona method of electrical precipitation, which gives the efficiency of the process with pipes of different radii, lengths and values of the potential gradient and transverse velocity.

A description was also given of the possible nature of the corona rays, different kinds of ionization, and the way smoke and fume particles may be charged.

In a paper entitled "The Theoretical and Experimental Consideration of Electrical Precipitation," by Mr. A. F. Nesbit, it was pointed out that electrical precipitation of suspended matter in gases is inseparably connected with the phenomena of ionization and the laws of electrically charged bodies. Among the subjects discussed in this paper were: The general properties of particles suspended in gases; the atomic structure of matter; ions, nuclei, aggregates; ionization. Apparatus for precipitating smoke, cement, ashes, etc., was described and its operation explained. Attention was called to the fact that negative corona is more effective in precipitating particles than is positive corona. Any irregularities on either of the electrodes of the precipitator tend to localize the discharge, thereby lowering the efficiency of the apparatus.

Practical Applications of Electrical Precipitation

The third paper on the subject, which was presented by Mr. Linn Bradley, was entitled "Practical Applications of Electrical Precipitation and Progress of the Research Corporation." The paper contained a description of several electrical precipitator plants. Voltages, electrode spacings, energy consumption, etc., were specified for a number of equipments precipitating fumes from silver-refinery gases, hydrated tin chloride from a chlorine detinning plant, zinc oxide from a roasting mill, tar from illuminating gas, sulphuric acid from a silver refinery, powdered organic materials from gases, etc. In general the eliminators consist of flues equipped with coaxial electrodes.

After presenting his paper, Mr. Bradley demonstrated how effectively corona discharges can precipitate carbon dust. The equipment employed consisted of a 5-kva,

100,000-volt transformer operating at 40,000 volts, a mechanical commutator driven by a single-phase, self-starting motor operating at 1800 r.p.m., and a flue containing a coaxial electrode. Motion pictures were also exhibited to show different installations described in the paper.

Discussion

Mr. S. Dushman called attention to a new compact rectifier capable of carrying currents ranging from 0.1 amp to 0.5 amp and operating at pressures up to 100,000 volts. The device contains no moving parts and depends for its operation on the electron emission of a hot body in high vacuum. When currents of several amperes are required several of the devices can be connected in parallel, each one having an efficiency of over 90 per cent, it was declared.

Prof. W. S. Franklin recommended connecting a condenser outside the choke coils used in the transformer circuit. Mr. A. F. Nesbit declared that the rectifier described by Mr. Dushman had been tested and proved satisfactory. In answer to questions by Mr. J. B. Taylor, Professor Franklin replied that precipitation can hardly be attributed to the attraction or repulsion of charged bodies, as the forces are too small. He expressed the belief that ionization accounts for the entire process. Dr. W. W. Strong said that precipitation does not become perceptible until corona starts, after which it increases up to the spark-over point. Mr. Bradley pointed out that too high potentials may blow away precipitated dust. Mr. S. M. Kintner said that condensers are too expensive for the protection they afford electrical precipitators.

Electrical Porcelain

A thorough treatise on "Electrical Porcelain" was presented by Prof. E. E. F. Creighton. The first part treated of conditions to which insulators are subject in use; duration characteristics of three kinds of surges; rise of voltage with the surges and the frequencies involved; construction of a high-frequency testing set; control and measurement of voltage; kva rating of the oscillator; reproductions of operating conditions; tentative recommended tests; operators' opinions and experiences; extent to which high frequency should be applied; heating effects of corona and sparks. Under the general subject of manufacture of electrical porcelain the following details were treated: Desirable qualities in porcelain insulators; dry process versus wet process; proportion of constituents and difficulties in maintaining these relations; glazing and firing, and flaws developed during drying process. It was pointed out that the quality of porcelain insulators depends almost entirely on the mechanical processes employed. The last section included remarks on the significance of tests; percentage of failures as a basis for rejecting insulators; welding of puncture holes by high-frequency wave trains; choice of test pieces; relations of puncture voltage to thickness of porcelain; development of faults and methods of examination; arc-over voltage of bushings; tests with super-spark potential; testing strings of insulators, and voltage-gradient tests.

Discussion

Mr. A. O. Austin presented a written discussion and explained motion pictures illustrating tests of various forms of insulators and insulator parts. He said that the ordinary brush discharge around insulators being tested will not damage the insulator unless followed by a power arc. He also pointed out that the better class of insulators do not fail from high-frequency as much as from other causes. High-frequency tests, if continued very long, will raise the temperature of the small air spaces in insulators and cause destruction, and hence the rate at which punctures occur should be observed rather than the number of punctures. At normal frequencies small insulators can be tested with higher voltages than large ones, but if a large and a small unit are connected in multiple with an air-gap in series the small insulator will flash over first. When the frequency is increased gradually it will be found that the flash-over point of a large insulator will be lowered much more rapidly than that of the smaller unit. The speaker also said that no one test appears to be sufficient, and therefore factory routine tests should include tests at normal frequency, high frequency and "kick" or resistance methods. Mr. J. T. Lawson spoke of the success which the Public Service Electric Company of New Jersey has had with high-frequency testing in weeding out faulty insulators. During the past year this company has tested 25,000 insulators, of which 21,000 were of the pin type and 4000 were of the disk type. By eliminating the faulty insulators service interruptions have been reduced from 65 per cent to 45 per cent. Most of the insulators are designed to flash over at half the voltage that is required to puncture them.

Mr. Austin expressed the belief that it is wrong to have a ratio as high as two to one and suggested that it would be better to have the proportion of one and three-tenths to one. Mr. P. W. Sothman did not consider that high-frequency tests do away with all other tests. He suggested that manufacturers should endeavor to develop uniform products and that they eliminate faulty parts before they are assembled. Definite frequency should be employed in testing. Mr. L. L. Israel referred to radiotelegraph insulator tests which are being made by the United States Navy. He declared that break-down is caused in most cases by heating. He pointed out that if the natural frequency of the insulator circuit is not the same as that of the exciter, wave-forms will be different from what they are when the frequencies are the same. The length of an arc in series with insulators will also have an effect upon the wave-form.

Mr. R. P. Jackson commented on the advantages and disadvantages of high-frequency oscillators and the impact tests. He pointed out that the Tesla coil is portable and not dangerous to handle. Either impact or the high-frequency tests will indicate the presence of faults, but neither should be continued for a long time as it may destroy the insulator. The speaker described equipment for controlling the number of discharges and consequently the amount of heat. When using this apparatus direct-current power is suddenly applied to the primary of the transformer and then gradually reduced by inserting resistance in the circuit. Tests made with this apparatus show that the insulator will withstand stress in one direction longer than if the stress is reversed periodically. Mr. William Jacobi called attention to points which should be considered by designers of insulators. He declared that failures produced during operation are very similar to those developed in tests. Internal stresses were cited as the principal cause of failure. Mr. Julian Cleveland Smith presented data showing that strain and suspension insulators fail in about the same proportion but that the line ends of the latter type fail more than do the intermediate or opposite end units. He declared that he has not obtained good results with high-frequency tests. Attention was called to the fact that failures usually occur in similar position and are generally caused by expansion of the cap. He reported that the new types of insulators have been found to be almost immune to temperature failures. Dr. Creighton closed the discussion by answering questions and showing samples of insulators which had been broken down and explained how they should be analyzed.

Calculation of Electromagnet Windings

Development of Formulas for the Design of Various Types of Cylindrical Electromagnets and Discussion of Their Application

BY E. E. GEORGE AND HAROLD PENDER

IN this article are given a series of practical equations for the design of cylindrical electromagnets wound with any kind of round wire and insulated with any thickness of insulation. A complete development of the formulas is first given, and then the procedure to be followed in their application. For any given set of data only a few formulas need be used, but the particular formulas to be used in any case will depend upon what data are given. In certain cases equations of an order higher than the second occur; such equations, although they are capable of a direct analytical solution, are here solved by graphical methods, since for the problem in hand the latter methods are simpler and require less time and effort.

Notation.—The following notation is used throughout:

A = area of the cross-section of the wire in circular mils.

E = voltage of circuit across which the winding is to be connected.

F = length of wire in the winding, in feet.

I = amperes taken by the winding.

K = specific resistance of the conductor in ohms per circular mil-foot at the working temperature t of the winding. Calling K_0 the specific resistance in ohms per circular-mil-foot at 0 deg. C. and T the reciprocal of the temperature coefficient of the conductor referred to 0 deg. C., then the value of K for a working temperature of t deg. C. is $K = K_0\left(\frac{T+t}{T}\right)$. For commercial annealed copper K_0 is 9.59, the temperature coefficient is 0.00426, and therefore T is $1 \div 0.00426 = 235$.

L = length of winding space (length of cylinder), in inches.

P = heat developed in winding at the working temperature t, in watts.

P_r = heat radiated at the working temperature t, in watts.

R = resistance of the coil at the working temperature t, in ohms.

r_i = inside radius of the winding, in inches.

r_o = outside radius of the winding, in inches.

s = the "space-factor" of the winding; i. e., the ratio of the space occupied by the conductor to the total space including the conductor, insulation and voids. Calling d the diameter of the wire in inches and i the thickness of the insulation in inches, then $s = \frac{\pi}{4}\left(\frac{d}{d+2i}\right)^2$. Values of s for different sizes of wire and insulation thicknesses are given in Fig. 1.

S = number of turns in the winding,

(SI) = number of ampere-turns, given as a single number.

t = working temperature of the winding, in deg. C.

t_a = temperature of the surrounding air, in deg. C.

w = watts radiated per square inch of exposed surface of the winding per deg. C. difference in temperature between the winding and the surrounding air. w is usually of the order of 0.002 watts per square inch per deg. C.

Fundamental Relations.—The total volume, in cubic inches, of the cylindrical winding space of length L, internal radius r_i and external radius r_o, is $\pi\,(r_o^2 - r_i^2)\,L$. The volume of the conductor in this space is s times the total volume. The volume of the conductor can also be expressed in terms of the length F of the wire and the cross-section A of the wire in circular mils. Equating these two expressions for the volume of the conductor gives

$$F = \frac{sL\,(r_o^2 - r_i^2)}{3 \times 10^{-6} A} \qquad (1)$$

The resistance R of the length F of wire having a cross-section of A circular mils and a specific resistance of K ohms per circular-mil-foot at the working temperature t is

$$R = K\frac{F}{A} \qquad (2)$$

Substituting for F its value from (1) gives

$$R = \frac{KsL\,(r_o^2 - r_i^2)}{3 \times 10^{-6} A^2} \qquad (3)$$

The cross-section, in square inches, of the winding space perpendicular to the direction of the wire is $(r_o - r_i)L$, and the portion of this cross-section occupied by the conductor is $s(r_o - r_i)L$. Dividing this latter area by the cross-section of the wire in square inches gives the number of turns S in the winding, viz.,

$$S = \frac{4\,s\,L\,(r_o - r_i)}{\pi \times 10^{-6} A} \qquad (4)$$

The amperes I taken by the winding are equal to the voltage E divided by the resistance R; therefore, the number of turns may also be expressed by the formula

$$S = \frac{R(SI)}{E} \qquad (5)$$

Substituting for R and S in this equation their values as given by equations (3) and (4) gives

$$A = \frac{\pi K\,(SI)\,(r_o + r_i)}{12\,E} \qquad (6)$$

The last expression shows that when the ampere-turns, the internal and external radii of the winding space and the specific resistance of the conductor are fixed, then the size of wire is likewise fixed. By selecting a suitable outside radius, however, the wire may be made of the proper size to prevent overheating.

To prevent overheating the wire must be of such a size that the heat developed in the winding will be equal to the heat radiated from the exposed surface of the winding. In many commercial designs only the cylindrical surface of the coil need be considered as radiating heat, particularly if the watts radiated per square inch per deg. C. (the constant w) be determined experimentally from a consideration of the cylindrical surface only. This cylindrical surface is $2\pi r_o L$, and therefore the total watts radiated are

$$P_r = 2\pi r_o L\,w\,(t - t_a) \qquad (7)$$

The heat in watts developed in the coil is equal to the resistance R multiplied by the square of the current I, that is, $P = RI^2 = R(SI)^2 \div S^2$. Substituting for R and S in this last expression their values from (3) and (4) gives

$$P = \frac{\pi^2 \times 10^{-6}}{48} \cdot \frac{K\,(SI)^2\,(r_o + r_i)}{s\,L\,(r_o - r_i)} \qquad (8)$$

Equating (7) and (8) gives

$$\frac{\pi^2 \times 10^{-8}}{48} \cdot \frac{K\,(SI)^2\,(r_o + r_i)}{s\,L\,(r_o - r_i)} = 2\,\pi\,r_o\,L\,w\,(t - t_a) \qquad (9)$$

which is a quadratic in r_o. Putting

$$M = \frac{\pi \times 10^{-8}}{96} \cdot \frac{K\,(SI)^2}{s\,w\,L^2\,(t - t_a)} \qquad (10)$$

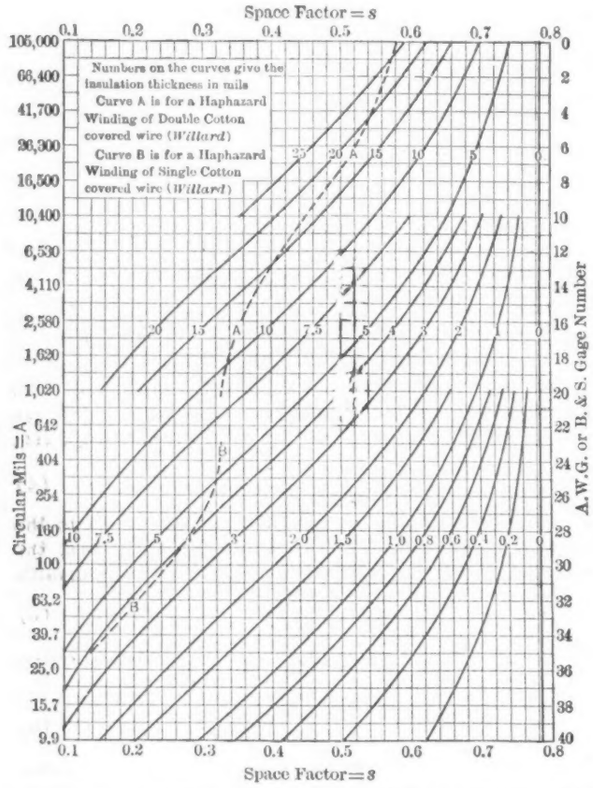
the solution of this quadratic is

$$r_o = \frac{M + r_i + \sqrt{(M + r_i)^2 + 4\,M\,r_i}}{2} \qquad (11)$$

Having found the external radius r_o, the required cross-section of wire is given by equation (6).

(In case more than the cylindrical surface is to be considered, put H = the ratio of the surface considered to the cylindrical surface; this ratio H will be some function of r_o. Plot the curve

$$y = \frac{r_o\,(r_o - r_i)\,H}{r_o + r_i} \qquad (12)$$


Space Factor = s
Numbers on the curves give the insulation thickness in mils
Curve A is for a Haphazard Winding of Double Cotton covered wire (Willard)
Curve B is for a Haphazard Winding of Single Cotton covered wire (Willard)
Circular Mils = A
A.W.G. or B. & S. Gage Number
Space Factor = s

VARIATION OF INSULATION THICKNESS WITH SPACE FACTOR*

The value of r_o which makes y equal to M—see equation 10—is then the required external radius.)

Procedure in Calculation

The problem is usually to find the size of wire and the external radius, all the other data being given except the space factor s, which depends on size of wire.

Assume for the space factor s a reasonable preliminary value (see Chart), and using this value of s calculate M from equation (10), then r_o from equation (11), and finally A from equation (6). If the value of s corresponding to this value of A (see Fig. 1) differs appreciably from the assumed value of s, recalculate M, r_o and A, using the value of s corresponding to the first value of A, and repeat until a value of A is found such that the value of s assumed in its calculation agrees with the value of s corresponding to the calculated value of A. In general, but one recalculation will be necessary.

This final value of A will not in general correspond exactly, or sufficiently nearly, to a commercial size of wire. The value of A as thus calculated will therefore be referred to below as the "theoretical" cross-section, to distinguish it from that of the commercial size actually used. To utilize a commercial size of wire any one of the following modifications in design may be made:

Case I.—Keeping the ampere-turns unaltered, the nearest commercial size of wire may be chosen, of the next smaller or next larger cross-section, depending upon which is more important, low temperature or low cost of wire, respectively.

Case II.—The nearest commercial size of wire may be chosen and the ampere-turns (SI) altered to keep the temperature t of the winding the same as originally assumed.

Case III.—The ampere-turns (SI) and the average temperature t of the winding may both be kept unaltered by using two coils of adjacent wire sizes, one coil wound over the other, sleeve fashion, and the two connected in series. (The coil of the smaller wire will reach the higher temperature and should preferably be the outside coil.)

Case IV.—Same as Case III, but the two coils arranged side by side with the same external radius.

Calculations for Case I.—The two unknowns are the external radius r_o and the working temperature t. Equations (6) and (9) may be written

$$r_o = \frac{12\,E\,A}{\pi\,K\,(SI)} - r_i \qquad (13)$$

$$t = t_a + \frac{\pi \times 10^{-8}}{96} \cdot \frac{K\,(SI)^2\,(r_o + r_i)}{s\,w\,L^2\,r_o\,(r_o - r_i)} \qquad (14)$$

The specific resistance K in these two equations is a function of the working temperature t, but since the change in K per deg. C. is less than 0.5 per cent, the variation of K for such small changes in t as will result from changing from the "theoretical" cross-section to the nearest commercial size of wire may, as a first approximation, be neglected, particularly in view of the uncertainty in regard to the exact value of the radiation coefficient w.

Proceed then as follows: Take for K the value used in calculating the theoretical cross-section and calculate r_o from (13), using for A the cross-section of a commercial size of wire to one side or the other of the theoretical cross-section. Substitution of this new value of r_o in (14) will give the working temperature of the winding. If desired, K may now be corrected to agree with this temperature, and another calculation of r_o and t made, and so on, until the value of K assumed in calculating t agrees with the value of t as calculated.†

The length F of wire required may then be calculated by equation (1), the resistance R from equation (2), and the number of turns S from equation (5). The current is then $I = (SI) \div S$.

Calculations for Case II.—The two unknowns are the ampere-turns (SI) and the external radius r_o. Equation (6) may be written

*From "American Handbook for Electrical Engineers," by Harold Pender.

†When the accuracy of the given data warrants, r_o and t may be calculated directly, without recourse to the "cut-and-try" method above described, by proceeding as follows: Put

$$Q = \frac{\pi \times 10^{-8}}{96} \cdot \frac{K_o\,(SI)^2\,(r_o + r_i)}{s\,w\,L^2\,T\,r_o\,(r_o - r_i)},$$

where K_o is the specific resistance in ohms per circular-mil-foot at 0 deg. C.; then equations (13) and (14) may be written

$$t = \frac{12\,E\,A\,T}{\pi\,K_o\,(SI)\,(r_o + r_i)} - T \qquad (13a)$$

and

$$t = \frac{t_a + Q\,T}{1 - Q} \qquad (14a)$$

Plot these two equations as curves, with r_o as abscissas and t as ordinates; their point of intersection will then give the proper value of r_o and t. The calculation of three points on each curve will usually be sufficient to determine their intersection; namely, the point corresponding to the "theoretical" value of r_o, a point corresponding to a value of r_o 10 per cent greater than this theoretical value, and a point corresponding to a value of r_o 10 per cent less than this theoretical value.

$$(SI) = \frac{12\,E\,A}{\pi\,K\,(r_o + r_i)} \qquad (15)$$

Substituting this value of (SI) in equation (9) and putting

$$N = \frac{3 \times 10^{-6}}{2\,\pi} \cdot \frac{E^2 A^3}{K\,s\,w\,L^2\,(t - t_a)} \qquad (16)$$

gives

$$r_o\,(r_o^2 - r_i^3) = N \qquad (17)$$

Plot the left-hand side of (17) as ordinates against r_o as abscissa; the value of r_o for which the ordinate of this curve equals N is the required external radius. Usually only three points on the curve need be plotted, namely for r_o equal to the value corresponding to the theoretical cross-section, and for r_o say 10 per cent greater and 10 per cent less than this value. Substituting in (15) the value of r_o which satisfies (17) gives the ampere-turns (SI).

The length of wire required may then be calculated by equation (1), the resistance R by equation (2), and the number of turns by equation (5). The current is then $I = (SI) \div S$.

Calculations for Case III.—The two unknowns are the external radius r_e of the outer coil and the external radius r_c of the inner coil (= the internal radius of the outer coil). Let A, s, R, S and F refer to the theoretical single-coil winding, calculated as above described, let A_1, s_1, R_1, S_1 and F_1 refer to the coil wound with the nearest commercial size of wire having a cross-section less than A, and let A_2, s_2, R_2, S_2 and F_2 refer to the coil wound with the nearest commercial size of wire having a cross-section greater than A. The external radius of the theoretical single-coil winding will be designated as r_o. In the two-coil winding the smaller wire will be used for the outside coil; hence the external and internal radii corresponding to A_1 are r_e and r_c, and the external and internal radii corresponding to A_2 are r_c and r_i.

From the same average working temperature t, the total heat developed in the two-coil winding must be to the heat developed in the theoretical single-coil winding as the external radius r_e of the two-coil winding is to the external radius r_o of the theoretical single-coil winding. Since the heat developed in each case is equal to the square of the total voltage divided by the total resistance, it follows that these resistances must be inversely proportional to the external radii; that is,

$$\frac{R_1 + R_2}{R} = \frac{r_o}{r_e} \qquad (18)$$

Since the voltage E is constant, the current for the two-coil winding must be to the current for the single-coil winding as the resistance R of the single-coil winding is to the total resistance $(R_1 + R_2)$ of the two-coil winding. Hence for the same total number of ampere-turns in the two cases the total number of turns $(S_1 + S_2)$ for the two-coil winding must be to the number of turns S for the single-coil winding as $(R_1 + R_2)$ is to R. But from (18) the resistance $(R_1 + R_2)$ is to the resistance R as the external radius r_o is to the external radius r_e. Therefore

$$\frac{S_1 + S_2}{S} = \frac{r_o}{r_e} \qquad (19)$$

Equations (3) and (4) apply to either coil in the case of a two-coil winding, as well as to the single-coil winding, provided the symbols are properly interpreted. Hence, substituting in equation (18) the values of R, R_1 and R_2 from equation (3), and in equation (19) the values of S, S_1 and S_2 from equation (4), and solving the resulting expressions for r_c in terms of r_e, gives

$$r_c = \frac{r_o A_1 A_2 s\,(r_o - r_i) + r_e A\,(s_2 A_1 r_i - s_1 A_2 r_e)}{r_e A\,(s_2 A_1 - s_1 A_2)} \qquad (20)$$

$$r_c = \sqrt{\frac{r_o A_1^2 A_2^2 s (r_o^3 - r_i^3) + r_e A^2 (s_2 A_1^2 r_i^3 - s_1 A_2^2 r_e^3)}{r_e A^2\,(s_2 A_1^2 - s_1 A_2^2)}} \qquad (21)$$

The procedure then is to calculate the theoretical cross-section A from equations (10), (11) and (6) as above described, and to find (from Fig. 1 or from a wire table) the commercial cross-section A_1 next below A and the commercial cross-section A_2 next above A. Then plot equations (20) and (21) as curves, taking r_e for abscissas and r_c for ordinates; the point of intersection of these two curves then gives the proper values of r_c and r_e. Usually only three points on each curve need be calculated, corresponding, say, to $r_e = r_o$, r_e 10 per cent less than r_o, and r_e 10 per cent greater than r_o. Having found the proper values of r_c and r_e, the number of turns required in the two coils are respectively (see equation 4),

$$\left.\begin{aligned} S_1 &= \frac{4\,s_1 L\,(r_e - r_c)}{\pi \times 10^{-6} A_1} \\ S_2 &= \frac{4\,s_2 L\,(r_c - r_i)}{\pi \times 10^{-6} A_2} \end{aligned}\right\} \qquad (22)$$

and the lengths of wire in feet required are respectively

$$\left.\begin{aligned} F_1 &= \frac{\pi\,S_1\,(r_e + r_c)}{12} \\ F_2 &= \frac{\pi\,S_2\,(r_c + r_i)}{12} \end{aligned}\right\} \qquad (23)$$

Calculations for Case IV.—The two unknowns are the external radius r_e of the two coils and the length L_1 of one coil; the length of the second coil is $L_2 = L - L_1$, where L is the total length of the winding space. Let A, s, R, S and F refer to the theoretical single-coil winding, calculated as above described; let A_1, s_1, R_1, S_1 and F_1 refer to the coil of length L_1, and A_2, s_2, R_2, S_2 and F_2 refer to the coil of length $L_2 = L - L_1$. Equations (18) and (19) apply to this case as well as to Case III. Equations (3) and (4) likewise apply to either coil, provided the symbols are properly interpreted; i. e., for the first coil L in these equations must be taken equal to L_1 and for the second coil equal to $(L - L_1)$. Hence, substituting in equation (18) the values of R, R_1 and R_2 from equation (3), and in equation (19) the values of S, S_1 and S_2 from equation (4), and solving the resulting expressions for L_1 in terms of r_e, gives

$$L_1 = \frac{r_o s L\,(r_o^3 - r_i^3)\,A_1^3 A_2^3}{r_e A^3\,(r_e^3 - r_i^3)\,(s_1 A_2^3 - s_2 A_1^3)} - \frac{s_2 A_1^3 L}{(s_1 A_2^3 - s_2 A_1^3)} \qquad (24)$$

$$L_1 = \frac{r_o s L\,(r_o - r_i)\,A_1 A_2}{r_e A\,(r_e - r_i)\,(s_1 A_2 - s_2 A_1)} - \frac{s_2 A_1 L}{(s_1 A_2 - s_2 A_1)} \qquad (25)$$

The procedure then is to calculate the theoretical cross-section A from equations (10), (11) and (6) as above described, and to find (from Fig. 1 or from a wire table) the commercial cross-section A_1 next below A, and the commercial cross-section A_2 next above A. Then plot equations (24) and (25) as curves, taking r_e for abscissas and L_1 for ordinates; the point of intersection of these two curves gives the proper values of L_1 and r_e. Usually only three points on each curve need be calculated, corresponding, say, to $r_e = r_o$ and r_e 10 per cent greater than r_o and r_e 10 per cent less than r_o. Having found the proper values of L_1 and r_e, the number of turns required in the two coils are, respectively (see equation 4),

$$\left.\begin{aligned} S_1 &= \frac{4\,s_1 L_1\,(r_e - r_i)}{\pi \times 10^{-6} A_1} \\ S_2 &= \frac{4\,s_2\,(L - L_1)\,(r_e - r_i)}{\pi \times 10^{-6} A_2} \end{aligned}\right\} \qquad (26)$$

and the lengths of wire in feet required are respectively

$$\left.\begin{aligned} F_1 &= \frac{\pi\,S_1\,(r_e + r_i)}{12} \\ F_2 &= \frac{\pi\,S_2\,(r_e + r_i)}{12} \end{aligned}\right\} \qquad (27)$$

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Short-Circuit Armature of Induction Motors.—J. Fischer-Hinnen.—A mathematical article in which are discussed the best dimensions of squirrel-cage armatures for induction motors and especially the question as to what cross-section should be chosen for the end rings and the cross bars. Since the slip depends only on the total resistance, it would seem that it does not matter how much resistance is in the cross bars and how much in the end rings, but in other respects there is a difference, and the author discusses what conditions are the most economical. If both the end rings and the cross bars are made from copper, the most economical ratio of the cross-section of the end ring to the total cross-section of all wires in a slot is $0.3\ U \div p$, where U is the number of slots and p the number of poles. If the cross bars are made from copper and the end rings from bronze, and if the ratio of the specific resistance of bronze to copper is 3.2 and the ratio of the cost per unit weight of copper to bronze is 0.72, the most economical ratio of the cross-section of the end ring to the total cross-section of all wires in a slot is $0.45 \times U \div p$. —*Elek. u. Masch.* (Vienna), Jan. 17, 1915.

Transformer Construction.—R. Edler.—A continuation of a profusely illustrated article on progress of transformer construction, relating especially to German practice. The present instalment deals with the construction of medium-size and large transformers.—*Helios*, Jan. 24, 1915.

Lamps and Lighting

Heating of Screw-Socket Lamp Holders.—Clifford C. Paterson.—An abstract of a paper based on a report to the "lampholder panel" of the engineering standards committee upon experiments carried out at the National Physical Laboratory. The tests were made with a view to the investigation of the temperature rise in screw-socket lamp holders of different types when used first with radiators and second with lighting fittings. The maximum number of watts that may be safely transmitted by a screw-socket lamp holder de-

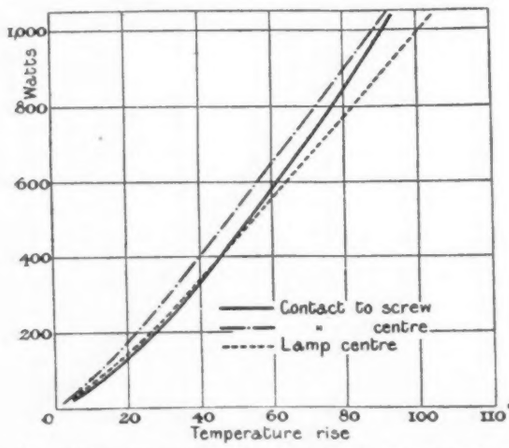


FIG. 1—RATIO OF TEMPERATURE RISE TO WATTS TRANSMITTED

pends on different considerations from those which prevail in the bayonet holder. In the screw socket connection is made to the lamp-cap terminals by what is equivalent to a clamped contact as the lamp is screwed into place. A rise of temperature such as the lamp itself is able to withstand has not been found in any way to affect the soundness of the contacts in the experiments made. In determining the maximum rating of a lamp socket, however, there is the factor of the heat that is conducted along the cable that supplies the energy to the lamp. It is matter of real importance in the design and rating of such sockets to know to what temperatures the insulation of the cables is subjected under working conditions. Measurements of the con-

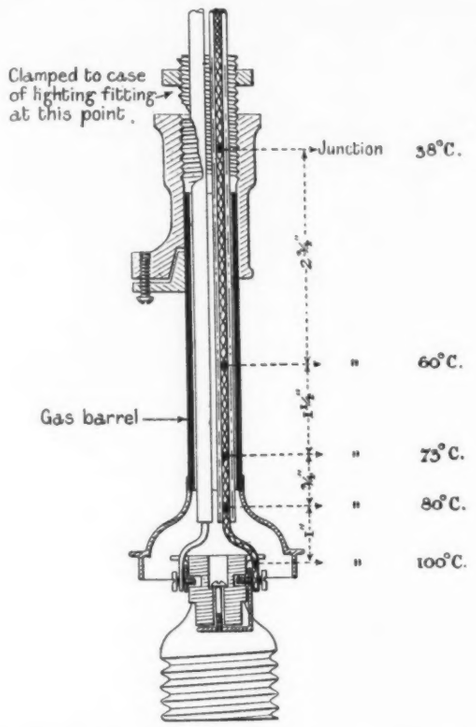


FIG. 2—ARRANGEMENT OF CABLE AND METHOD OF JUNCTION

tact resistance of the various sockets show that the actual I^2R losses due to current passing through the contacts are negligible, and that all the heating is caused by conduction and radiation from the lamp itself. The wattage of the lamp is, therefore, the main factor to be considered. The general conclusions arrived at as the result of the experiments are: (*a*) that, as far as temperature rise is concerned, ordinary screw-socket holders may be used for radiator elements up to at least 500 watts each (the maximum size of heater element at present on the market); (*b*) the screw contact is also satisfactory, as at present used, for lamps rated up to at least 1000 watts, but in the present designs the clamping contacts for the incoming leads become too hot to allow rubber-insulated cables to be brought directly into the sockets without risk of serious deterioration of the rubber. The results are summarized in Fig. 1, in which the mean temperature rise of all the sockets is plotted against the number of watts transmitted. This gives a general indication of the temperature likely to be reached for any given lamp rating. As a general rule, the number of watts divided by ten gives in degrees Centigrade the approximate temperature rise of the socket above the air. Tests were also made to ascertain what the temperature gradient along the cables was as it left the socket and was led up the length of ¾-in. gas barrel shown in Fig. 2. Thermocouples were inserted at intervals underneath the insulation of the cable. The arrangement of the 3/18 S. W. G. cable and the junction

used are shown in Fig. 2. It will be seen that where the cables pass through the usually constricted neck of the socket the temperature rise is around 90 deg. C. when the clamping piece is at 100 deg. C. Three inches up the tube the temperature rise is about 60 deg. C.—London *Electrician*, Feb. 5, 1915.

Generation, Transmission and Distribution

Hydroelectric Development of the Peninsular Power Company.—CHARLES V. SEASTONE.—A paper read before the American Institute of Mining Engineers. The hydroelectric plant of the Peninsular Power Company is at the Lower Twin Falls on the Menominee River, about 3.5 miles north of the city of Iron Mountain, Mich. The principal points of delivery of electric energy from this plant are in the mining regions adjacent to Florence, Wis., and Iron River, Mich., and in the cities of Iron River and Iron Mountain. The hydroelectric plant at Twin Falls and the substation of the Iron Mountain Electric Light & Power Company are connected by a 6600-volt transmission line carried on steel towers and steel poles, the latter being used within the city limits. The plant at Twin Falls and the substation at Iron River, about 36 miles distant, are connected by a 66,000-volt duplicate three-phase transmission line supported on steel towers. At Iron River are situated a 1500-kw auxiliary steam plant and the substation from which the energy is distributed to the mines in that vicinity. The superstructure of the power house is constructed for the present installation of three 1000-kw generating units, and the substructure has been completed for the two additional 1000-kw units which are to be installed in the near future. The generators have a rating of 1250 kva, 6600 volts, sixty cycles, three-phase, 257 r.p.m., each equipped with a 120-volt directly connected shunt-wound exciter of 27.5-kw rating, designed for operation with a Tirrill regulator. The rotor of the generator is of the flywheel type and is so designed as to assist materially in the speed regulation of the plant. All rotating parts are designed for 60 per cent overspeed. The ultimate transformer installation will comprise six single-phase, 835-kva oil-insulated, water-cooled transformers, arranged in two banks, delta-connected on the low-tension side, receiving 6600 volts, and star-connected on the high-tension side, delivering 66,000 volts. The present equipment consists of one bank of transformers with one extra single-phase unit acting as a spare.—*Bull. Amer. Inst. of Min. Eng.*, February, 1915.

Traction

Railway Equipment.—J. F. LAYNG.—The author deals with some of the important considerations governing the selection of car equipments for city and suburban service. By making an analysis of the pressures of wheel threads he determines the method of mounting the motors that will give the maximum adhesion available for traction. It is then possible to determine the equipment that will be most suitable to operate on severe grade conditions, and also to obtain the best schedule speed on all rail conditions.—*Gen. Elec. Review*, February, 1915.

Towing Locomotives.—C. W. LARSON.—An illustrated description of the ship-towing locomotive used at the locks of the Panama Canal. The first part of the article is devoted to the presentation of the reasons why none of the hitherto existing systems of maneuvering ships in close quarters could be satisfactorily applied to the locks of this canal. This is followed by a description of the system developed to fulfil the conditions. Next is a minute description of the locomotives themselves.—*Gen. Elec. Review*, February, 1915.

Storage-Battery Locomotives for Mines.—J. W. GWINN.—A paper read before the American Institute of Mining Engineers. The underground haulage system in the lead-silver mine of the Bunker Hill & Sullivan Company, situated at Kellogg, Idaho, is the most extensive in the Cœur d'Alene district, comprising about 35,000 ft. of tunnels, drifts and cross-cuts where locomotive haulage is in use. Formerly the trolley system was used, but since 1913 three storage-battery locomotives have been installed. The first has a weight of 5000 lb. and two motors, and the battery equipment consists of sixty-three cells of Edison type A4, with a rating of 112 ton-miles on a single charge. The ampere-hour rating is 150. The locomotive is equipped with two batteries, so that one may be left at the charging station to be charged while the other is on duty. The second locomotive has a weight of 7600 lb., two motors and a battery, Edison type A8, consisting of seventy cells, with a discharge rating of 300 amp. The third locomotive has a weight of 8000 lb. and two motors, and the battery consists of seventy Edison type A8 cells having a discharge rating of 300 amp. Each of the last two locomotives has only a single battery of cells, of sufficient power to run on full load for the required length of time. For charging purposes a motor-generator set, 125-volt, three-phase, 50-hp motor, installed in the hoist room on No. 9 level, takes energy from the 2300-volt alternating-current line and delivers 125 volts direct current to the charging stations on each level. The author gives data on performance, efficiency, maintenance and repair costs, and concludes that with a few minor improvements in the charging system and a better understanding of and more careful attention to the operation of these locomotives by the motormen the costs of repair and operation will be 75 per cent less than for the trolley locomotives doing the same work. Other advantages of storage-battery haulage are that it does away with the dangerous trolley wire and gives an easy access to the face of a drift with the storage-battery locomotive.—*Bull. Amer. Inst. Min. Eng.*, February, 1915.

Installations, Systems and Appliances

London's Electricity Supply.—"Those who have taken an interest in the unification of electric supply in London will be pleased, or the opposite, but will hardly be surprised, that the latest London County Council scheme has gone the way of its forerunners. One is past surprise at the failure of attempts to deal with this problem. The intention to promote a bill was defeated, as far as this year's parliamentary session is concerned, at the meeting of the Council on Tuesday last. In order to proceed it was necessary that the proposal should be supported by a full majority, but, owing apparently to the absence of so many supporters on active service, only sixty votes out of a necessary sixty-nine were obtained. There were thirty dissentients. Had the scheme reached a parliamentary stage there was a possibility it might have gone through, but hardly at any time a probability. Very strong opposition from the borough councils recently developed. Defeat in a parliamentary committee room would, however, have been more satisfactory than this abandonment of the proposal by the body which created it. It is useless speculating what the new situation may ultimately lead to. The only certainty is that the field is now clear for the London electric supply company bill, which proposed a new company to deal with the matter, much on the lines of the County Council scheme, but over a considerably smaller area. Certain of the existing power companies, which are apparently interested in the bill, are to be compulsorily acquired. From the remainder opposition may be expected, as their areas are threatened. Municipal opposition goes without saying."—London *Engineering*, Feb. 5, 1915. The situation is also discussed in

London *Electrician*, Feb. 5, and London *Electrical Engineering*, Feb. 4. The first part of the report by the conference of metropolitan boroughs owning electricity undertakings on the London and district electricity supply bill is printed almost in full in London *Electrician*, Feb. 5, 1915.

Wires, Wiring and Conduits

Protective Switchgear for Mines.—C. JONES.—A paper illustrated by numerous diagrams, read before the Association of Mining Electrical Engineers (Warwickshire and South Staffordshire branch). After brief notes on the protection of generators and transformers, the author deals at greater length with feeder protection and gives details of the Merz-Price protective system, the Ferranti-Field system and other systems.—*London Iron and Coal Trades Review*, Feb. 5, 1915.

Electrophysics and Magnetism

Structure and Hysteresis Loss in Medium-Carbon Steel.—F. C. LANGENBERG AND R. G. WEBBER.—A paper read before the American Institute of Mining Engineers. During the course of some magnetic investigations six bars of 0.43 per cent carbon steel were tested, a permeameter designed after the Hopkinson-yoke type being used. The results obtained show the necessity for a careful investigation of the previous history of the samples under study as well as the chemical composition. A steel of given chemical composition may assume a great variety of structures, depending on its treatment. Of the six bars tested, Nos. 1, 2, 3 and 6 were pearlitic and Nos. 4 and 5 were sorbitic. In the first three bars the only variable factors are the relative size of grain and the coarseness of the striations of pearlite. Bar 1 has a large grain and the pearlite is coarsely laminated. Its hysteresis loss per cubic centimeter is 17,280. Bar 2 has a finer structure than No. 1 and shows a hysteresis loss of 18,240. Bar 3 is still finer than bar 2 and shows a hysteresis loss of 21,920. Bar 6 is also pearlitic and differs from Nos. 1, 2 and 3 in having a much finer structure. The hysteresis loss in this bar rises to 29,120 ergs per cubic centimeter, which is 68 per cent greater than the loss in bar 1. Therefore, with decreasing grain size Nos. 1, 2, 3 and 6 show a rise in their hysteresis loss, increasing residual B and increasing coercive force. Bar 4, comparable in grain size to bar 1, but differing from bar 1 in being sorbitic whereas No. 1 is pearlitic, shows an increase in its hysteresis loss of approximately 50 per cent. The authors emphasize that in magnetic testing careful attention must be given to the internal structure of the metal undergoing test. A mere statement of its condition as hardened or unhardened, annealed or tempered, is idle and often misleading. The results lead the authors to infer that a minimum hysteresis loss could be obtained by the combination of large grains with coarsely laminated pearlite.—*Bull. Amer. Inst. Min. Eng.*, February, 1915.

Electrochemistry and Batteries

Electrolytic Nickel.—R. RIEDEL.—An account of an experimental investigation of the decomposition of nickel from chloride solutions. Electrolysis was carried out in the presence of hydrochloric acid and acetic acid. The latter has various advantages. In order to get a good deposit of metallic nickel it is necessary to maintain a suitable current density, which depends on various factors of operation.—*Zeit. f. Elektrochemie*, Jan. 1, 1915.

Electrolytic Decomposition of Water.—An illustrated description of an electrolytic apparatus of the Oerlikon Company for the production of oxygen and hydrogen gases from water. They are built for 65 volts, 110 volts or 220 volts. In these cases twenty-eight or forty-eight or ninety-six cells are connected in series. Asbestos diaphragms are used in the cells. The electrolyte is a 10 per cent solution of potassium carbonate in distilled water. A temperature of 40 deg. C. is employed.—London *Electrician*, Jan. 29, 1915.

Telegraphy, Telephony and Signals

Telephone Receiver.—LEON BOUTHILLON AND LOUIS DROUET.—An account of an investigation of the vibrations of the diaphragm of a telephone receiver, made by observing with a microscope the displacement of a point fixed in the center of the diaphragm and perpendicular to it. The behavior of the diaphragm under the action of direct current and sinusoidal alternating current was studied. The sensibility of telephone receivers at a certain frequency and at different frequencies was also investigated.—*La Revue Elec.*, "Oct. 16, 1914 (published Jan. 15, 1915)."

Units, Measurements and Instruments

Induction-Coil Spark.—W. C. BAKER.—The spark of an induction coil following the "make" of the primary current is composed of a series of discharges, and similarly at "break." These are usually assumed to be oscillations in the secondary circuit consequent upon the single impulse due to the rise or fall of the current in the primary. The author describes some observations which show that, in certain coils at least, these partial sparks are not oscillatory but in each consist of groups of unidirectional pulses. Under certain conditions the partial sparks exhibit variations of intensity or "beads," suggesting strongly the beaded lightning of the meteorologist.—*Physical Review*, January, 1915.

Book Review

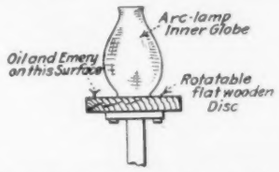
ELEMENTARY MATHEMATICAL ANALYSIS. A textbook for first-year college students. By Prof. Charles S. Slichter. New York: McGraw-Hill Book Company, Inc. 490 pages, 183 illus. Price, $2.50.

This volume is one of the series of modern mathematical textbooks edited by Professor Slichter. It appears to have been written primarily for the use of freshmen in the engineering courses of the University of Wisconsin. The volume is not intended to be a textbook on "practical" or "engineering" mathematics, but illustrations from science are freely used. The aim of the author may be learned from one sentence in the preface which is worth quoting: "The student should learn early in his course that an important purpose of mathematics is to express and to interpret the laws of actual phenomena, and not primarily to secure here and there certain computed results." If mathematics were always treated as the broadest of all the sciences, dealing quantitatively with real things and not merely with abstract numbers or with symbols of which the actual or possible meaning is rarely clear to the student, its study might conceivably be made more interesting to larger numbers, and there would be fewer graduating students who are practically incapable of stating a problem mathematically, or of forming a physical conception of the results attained by mathematical analysis, after they have applied the methods with which practice has rendered them familiar. It is perhaps difficult to see in mathematics more than a very perfect tool for the use of the scientist and engineer, but even if no broader view can be taken, it is at least essential that the tool should be used intelligently, in the most efficient manner, to attain a definite end. A book such as the one before us should be very helpful in giving to the student a broader view of mathematics than he can expect to obtain by following the usual courses of mathematical instruction.

POWER AND OPERATING SECTION

Grinder for Surfacing Ends of Arc-Lamp Inner Globes

After inner globes have been used with inclosed-arc lamps for a short time they frequently chip around the ends and allow air to circulate past the arc, thereby affecting the efficiency of the lamp. When this defect occurs some central-station companies throw the globes away. By employing a simple grinder, however, the



DEVICE FOR SURFACING ENDS OF INNER GLOBES

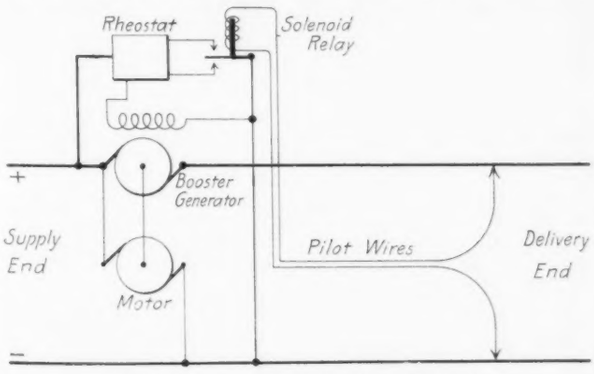
Newark arc-lamp department of the Public Service Electric Company of New Jersey has avoided scrapping most of the globes which would have been considered unusable heretofore. The grinder consists of a horizontal revolving wooden disk on which are sprinkled oil and emery. When pressed end downward on the disk slightly nicked globes can be quickly surfaced and made serviceable again.

"Report Defects; Avoid Accidents"

Among the slogans adopted by the Louisville Gas & Electric Company, Louisville, Ky., as the result of a recent safety campaign, is the following: "Report a defect and you will not have to report an accident. Safety first!" Prizes have been awarded by the employees' committee for the best suggestions received from the men in the plant and on the outside. Mr. A. W. Lee is chairman of the committee.

Apparatus for Maintaining Constant Pressure at Any Point on a Feeder

The equipment and connections represented in the accompanying diagram are being employed by the Edison Electric Illuminating Company of Brooklyn to maintain a constant pressure at any point on one of its

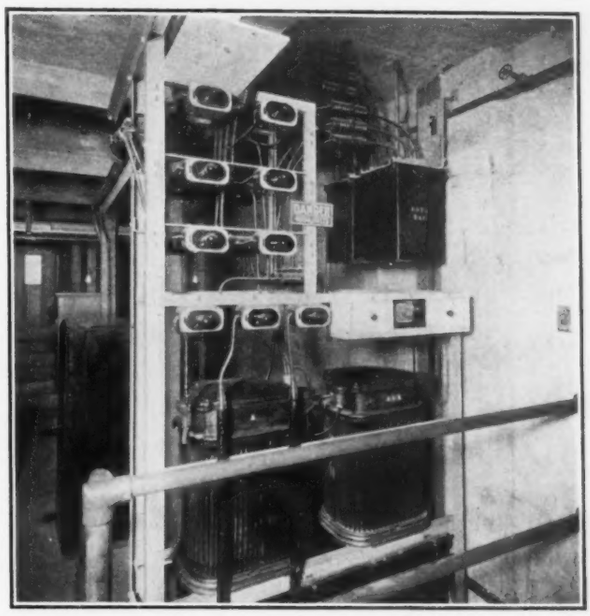


AUTOMATIC CONTROL FOR BOOSTER

feeders for the operation of a large portable air compressor used in subway construction. The compressor has to be moved along as work progresses and does not operate continuously, therefore it was necessary to isolate one 1,000,000-circ. mil feeder from all others to supply energy to the compressor motor. A booster generator was connected in series with one of the feeder leads and the field current automatically regulated by an electrically operated rheostat and a relay connected with the delivery end of the feeder by pilot wires. When voltage drop in the cable causes the pressure at the compressor motor to fall below the desired value the relay contactor will allow the rheostat arm to turn until the field current has increased sufficiently to bring the delivery-end voltage up to the proper value. The automatic control is capable of changing the supply-end pressure from zero-load to full-load value in ten seconds.

Use of Fuse Blocks as Station-Transformer Switches

The illustration herewith shows a bank of four single-phase transformers used for the supply of station lighting and motor service in a substation, the fourth unit being a spare transformer. By the arrangement



FUSE BLOCKS USED AS DISCONNECTING SWITCHES FOR STATION TRANSFORMERS

of fuse blocks illustrated any transformer can be cut out of service and the spare unit inserted in its place, or the entire three-phase group can be connected up to either of two station circuits. The use of the fuse blocks introduces a protective feature and, all things considered, proves cheaper to install than the usual disconnecting switches. A guard sheet of insulating material protects the hand of the man handling the uppermost left-hand plug from making possible contact with the structural steel work of the station building.

When to Clean Turbine Blades

In one of the medium-sized central stations in Ohio the operators gage the time for cleaning the turbine blades by observing the records produced by a steam-flow meter connected to the steam intake of the turbine. When the records from this flow meter and from other station instruments indicate that the 6000-kw turbo-generator is requiring 18 lb. of steam per kilowatt-hour

the operators know that conditions are just normal. But when the big machine requires 19 lb. of steam to produce 1 kw-hr. the engineer knows that scale forming from the impure feed water has begun to coat the turbine blades and that economic operation can be obtained only after the machine has been "taken down" and cleaned.

Locomobile Plants in the United States

At the present time only eight locomobile plants are in operation or in process of construction in the United States, although in Germany hundreds of these self-contained units are already giving successful service. The units in seven of the American plants are of American manufacture, and those in the remaining power house were made in Germany. Three of the plants contain two units each, and in the others the total rating of the station has been placed in one locomobile.

LOCOMOBILE PLANTS IN AMERICA

Geographical Location	Ownership	Type	Rating in Kw
Brooklyn, N. Y.	International Cork Company.	Buckeye.	75
Barberton, Ohio (two)	Barber Cement Products Company	Buckeye.	300
Limeton, Ohio (two)	O. C. Barber Mining & Fertiliser Company	Buckeye.	300
Fremont, Neb.	Fremont Gas, Electric Light & Power Company	Buckeye.	100
Riverton, Wyo.	Agie Light & Power Company	Buckeye.	50
Baltimore, Md.	Johns Hopkins University	Buckeye.	50
Corpus Christi, Tex. (two)	Corpus Christi Ice & Electric Company	Buckeye.	250
Beowawe, Nev.	Buckhorn Mining Company	Wolf	...

While the majority of these units are equipped to burn coal of different grades, three of them—namely, those at Riverton, Wyo., and Corpus Christi, Tex.—are provided with oil-burning furnaces.

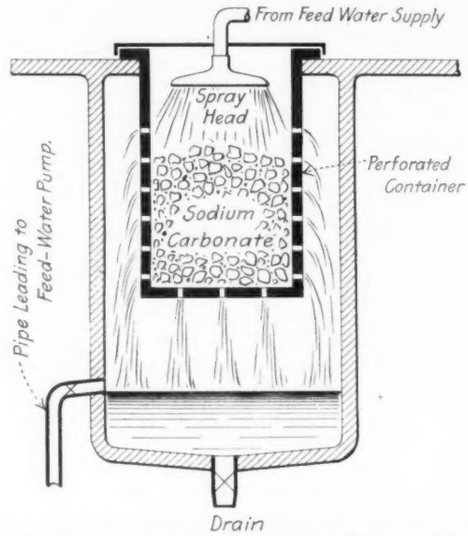
The Savings Which Boiler-Room Economies Can Effect

The manager of a certain 4500-kw electric-lighting plant in the Middle Western States found, with the close of 1914, that while the electrical output of the station had increased 20 per cent during the year, the coal tonnage had increased only 5 per cent. The annual load-factor at this plant was 39 per cent and the load-factor for December was 45 per cent. The "showing" made in the report did not come as a surprise to the manager, because he had spent much time urging the practice of economy in the boiler room and had himself taken the trouble to visit it at least once a day besides devoting some deep thought and individual attention to the engineer's problems.

When and How to Employ Water-Softening Compounds

If no attention is paid to the time at which softening compounds are added to boiler-feed water, it is possible that different amounts may be distributed to each boiler. If this happens, those boilers receiving an excess amount of compound will probably prime and other units not receiving enough will be coated with a considerable amount of scale. At the 201st Street station of the United Electric Light & Power Company, New York City, a solution of the compound is gradually fed to the feed-water pump during the early evening watch, when practically all of the boilers are generating steam in equal amounts. By this method each boiler receives its share of the softening compound.

As implied in the preceding paragraph, the impurities in the water are precipitated inside of the boilers, so no feed-water treating tank is required. As the compound employed by this company is crystalline sodium carbonate, however, it has to be dissolved before it can be utilized. The accompanying illustration shows the apparatus which is employed for this purpose. It consists of a cylindrical metal tank with a smaller perforated container supported concentrically within it. Placed over the perforated receptacle is a spray head connected with the feed-water supply pipe. Leading from several inches above the bottom of the outer tank to the intake of the feed-water pump is another pipe. By placing the crystalline sodium carbonate in the inner tank and turning on the spray the compound will be dissolved and carried to the feed-water pump, from which it will be distributed to the boilers.



APPARATUS FOR DISSOLVING FEED-WATER SOFTENING COMPOUND

The amount of sodium carbonate required in the boilers is determined from an analysis of the water. The crystals are then placed in the perforated receptacle and the flow of the water is regulated so that the compound will be dissolved during the watch in which all the boilers are supplying steam. It is the practice in this station to test the water in the boilers only during the early morning watch when plenty of banked boilers are available, and the boilers are blown off only when their fires are banked.

Coal Hopper Keeps Boiler Room Clean

A useful accessory which the operators of the American-built locomobile plant at Limeton, Ohio, have put into service is a wheeled coal hopper by means of which the fuel is hauled a few feet from the coal bins to the furnace door. Although the space between the coal storage and the furnace door is only about 10 ft. in width, the hopper is nevertheless considered very useful, because it removes the necessity of ever piling coal on the floor before the firing door and helps in this way to keep the boiler-room floor neat and clean. Besides aiding in keeping the station clean, this hopper is also of assistance in securing most economic firing condi-

tions, since the fireman can place the hopper in any position he considers most handy and can "put in a fire" and close the furnace door quickly without allowing an excess of cold air to rush over the grates.

COAL TRUCK FOR KEEPING BOILER ROOM CLEAN

These hoppers, of which there are two in the "Buckeye-mobile" plant at Limeton, are made of sheet metal riveted and bolted to an angle-iron frame. Two of the low wheels under the frame revolve on opposite ends of the same axle, while a third and still lighter and smaller wheel is in reality a large caster which, turning freely from side to side, allows the fireman to push the hopper in any direction. For the plants at Limeton the hoppers have been made to hold about 1000 lb. of coal, but it has been suggested that for other hand-fired plants these useful accessories could be made in sizes to suit the needs of the particular boiler to be served.

First-Aid Methods of Dayton Company

Stanch, neat, durable and convenient first-aid chests are now sent out with the construction crews of the

FIG. 1—PORTABLE FIRST-AID CHEST

Dayton Power & Light Company. Previously it had been, as it still is, the practice of the company to place wall cabinets in its buildings, but there arose the necessity for providing some kind of an outfit that could be carried in the wagons serving the linemen, so that these men, working sometimes in towns several miles from the nearest substation, could quickly attend to small wounds, thus preventing infection and consequent loss of time.

The design of chest selected is particularly well adapted for this sort of service, because when it is packed with its full quota of iodine, picric acid, turpentine, vaseline, peroxide, adhesive plaster, bandages, absorbent cotton, medicine droppers and scissors it may be placed in the construction truck along with the line material and hardware. The name of the contents of each bottle is printed on the big corks, and the corks themselves are held securely in place by wires which run over the tops of the corks and are fastened around the necks of the other bottles. By inside measurements the chest is about 12 in. long and 6 in. wide.

The interest which the construction men have taken in co-operating with the company in this first-aid and safety work was made evident not long ago when one of the foremen made application for two additions to his first-aid kit. He said he wanted an atomizer with which

FIG. 2—FIRST-AID CABINET FOR SUBSTATION

to apply the disinfecting compounds to cuts so that all parts of an open wound might be reached in a sanitary manner. The other part of his requisition called for a new healing remedy composed of iodine and other substances which this foreman had read were employed with success on the battlefields of Europe.

The type of safety cabinet used in the company's generating stations and substations is shown in Fig. 2. This kit, in addition to containing the remedies carried in the portable chest, is also provided with an upper compartment for holding a pair of rubber gloves.

Using Oil-Well Outfit to Raise Transmission Towers

In the oil fields of Ohio casings of "dry" wells are pulled from their positions in the ground by means of a portable derrick equipped with powerful block-and-tackle apparatus. Naturally, the owners of these derricks are not able to find continuous work for their machines in the oil field and welcome outside jobs, such as helping to raise transmission towers. One of the central-station companies which has taken advantage of this time-saving method of erecting high poles and square-base and A-frame towers is the Ohio Light & Power Company of Tiffin, Ohio. The 33,000-volt transmission line

recently completed by this company extends from Tiffin to Fostoria, and in that distance goes cross-lots through town and country, follows railroad rights-of-way and occupies city streets, so that practically every condition of pole-raising known to a flat country was encountered. In all places, however, the derrick proved effective, and it

TYPE OF A-FRAME TOWER RAISED BY OIL-WELL DERRICK

was estimated by Mr. Frank Espy, manager of the company, that the Archbold-Brady A-frame towers, which form the majority of the line supports, were erected in half the best time that had been found to be possible by any other method.

Wire Cutter for Freeing Shocked Linemen

While working on cross-arms linemen occasionally come in contact with conductors carrying dangerous voltages. While they may be rendered unconscious by a shock therefrom, it may be possible to save their lives if they are immediately separated from the wires. It is declared that recovery from a short shock is much quicker than recovery from a long one. To prevent delay in de-energizing a line which may have caused such an accident, the Wichita Falls (Tex.) Electric Company has provided its construction gangs with a device for cutting the wires without endangering the operator. The device, which is similar to a bolt cutter, is fastened to the end of a long wooden pole 3 in. in diameter and is operated by a rope. It will readily cut No. 0 copper wire.

Time Element Secured by Fuse Bridging Trip Coil

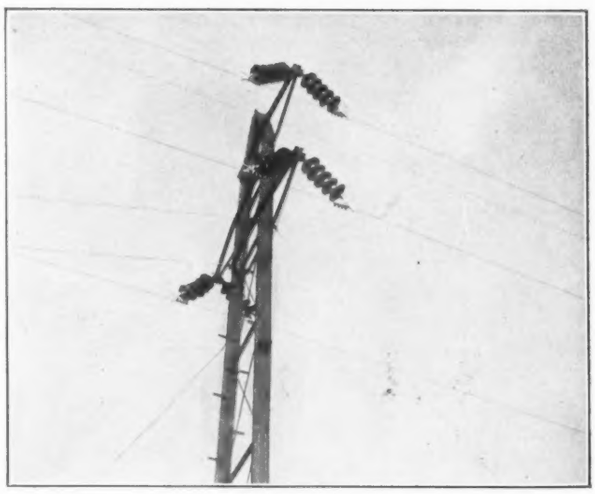
By bridging a 10-amp plug fuse across the trip coil of circuit-breakers in unattended substations, the Minneapolis General Electric Company secures a time element in the operation of the switch on sudden "jolts" without impairing the operation of the breaker on sustained overloads. A brief rush of current is shunted away from the trip coil by the fuse, but if the overload continues the fuse blows, deflecting the operating current into the coil and opening the breaker. Mr. L. D. Smith, general superintendent of the company's lines, assigns credit for this use of a fuse to the Toronto company and declares that its use on the Minneapolis system has been of value in preventing service interruptions due to temporary troubles. Because of the time lag inherent in the fuse, these troubles promptly cleared themselves.

Storm Guys Installed to Stay

With storm guys firmly anchoring the towers in four directions at the end of every mile, and with "semi-strains" interposed at half-mile intervals, the 33,000-volt transmission line of the Ohio Light & Power Company near Tiffin is thought to be well protected against failure due to wind stresses, unless assailed by a storm of cyclonic violence. The 46-ft. Archbold-Brady A-frame towers, which are used except at a few places in this line, are spaced about 400 ft. apart and support three lines of No. 1 stranded copper and a ground wire of 0.3125-in. steel messenger. For the most part angles at any one tower in this line were not allowed to exceed 3 deg. of arc, and the majority of angles, excepting the right-angle turns, were made to fall within about 1.5 deg. of arc.

To make the storm guys in this line of a permanent character the most important part of the guys—the dead-men—were made from 6 ft. to 10 ft. long. Pieces of cedar pole used for this purpose were fitted with 8-ft. by 0.75-in. rods and were buried 6.5 ft. in the ground.

At the heads of the towers where the 0.375-in. messenger wires are fastened a neat and effective method of attaching the guy to the tower was employed. This method consisted merely of removing a machine bolt from its position through one of the cross-arms or through one of the pole steps and replacing the machine bolt by an eye-bolt. The eye protruding at the point at which the guy was to be attached presented a con-



STORM GUYS ATTACHED TO TOWERS BY MEANS OF EYE-BOLTS

venient place in which to "serve up" the messenger wire. All of the hard work incident to wrapping the stiff steel-stranded wire around the frame of the tower was thus eliminated and the lineman's work was immensely simplified. Besides being a time-saver, this method of attaching wires has been found to make the tower very neat in appearance.

COMMERCIAL SECTION

Contracting on a Close Margin

IN this issue appears a short article on the inside workings of a contracting firm which points several morals that may be not without general value. If one analyzes the operations of many a concern, of what special kind it does not much matter, he will generally find that the success obtained depends on the suitability of the scheme or organization, the word "suitability" meaning a great deal more than appears on the surface. It is by no means rare that an elaborate organization which looks well on paper involves an excessive overhead expense. It is like the common drafting-room vice of making a drawing, let us say, of a special bolt and then laboriously putting in a title six times as large as the drawing itself. Straightforward, simple methods, orderly but not intricate, are those which lead to the best results. The method of minimizing the overhead costs herein described may be summarized as orderly and careful estimating, thorough preparation for the task, and close personal superintendence. Work done through a long chain of intermediaries is quite commonly badly done, and the contractor who does not supervise his own operations will regret the neglect almost as much as the customer. It is fortunate for the former if he can confine his attention to thoroughly first-class work and avoid cut-throat competition—the source of most bad work. A reckless habit of estimating on everything within possible sight does not make for profit—it really involves an economic loss which must inevitably be charged against the work actually undertaken. Wise and conscientious contractors will not be misled by this temptation.

Passing the Word to the Other Fellow

WHEN the new-business manager of the Jonesville central station discovers a new use for some electrical device, he quickly realizes the advantage of telling his own salesmen about the business to be secured right at home in Jonesville by promoting the new application. The average central-station man grasps such a commercial opportunity promptly and usually loses no time in applying it thoroughly to his own business organization. But, as a little reflection will show, he could go a great step further if he would write a letter —and perhaps send a photograph—telling the story of his discovery to the manufacturer of the device for which the new use had been found. This slight effort would place another powerful selling argument in the hands of the manufacturer's salesmen, and so the original idea would be spread and relayed to a thousand other villages, finding in each probably as many prospective users as in the town in which it originated. Perhaps some central-station men do not give out their ideas freely because they stop to question, "Why should I exert myself to aid the manufacturer to sell his goods, or take the trouble to help him show his other customers my sales arguments?" The broader answer to such a short-sighted policy becomes, of course, obvious when the central-station man considers how much of his own success is due to selling ideas and plans which he himself received from his salesman acquaintances.

The Best Salesman

THE best salesman is not the most persuasive one; he is not the one whose sales reach the highest total during the week. The best salesman is the one who in selling one appliance paves the way for selling more to the same customer. That salesman who can convince each customer that the electrical is the best, even if not the cheapest, way is one of the company's most valuable assets.

Commission Bonus on Sales

THE plan of paying salesmen a fair salary and a commission bonus on gross sales over a fixed amount may prove of great benefit to a utility company. The salesman will study the details, both mechanical and operating, of the devices he must sell; zest and interested effort will be put into his selling, and he will formulate suggestions for improvements to make the apparatus more salable. If the policy is pushed too far, however, the attendant results are apt to be decidedly disastrous. Too much effort will be put into selling the appliances and not enough energy into making the customer a permanent one. Too much will be promised of a flatiron, a grill or a percolator, etc., with the result that one more person who might otherwise become a champion of electrical methods becomes a decided enemy thereof.

Getting Together on Wiring Rules

FOR various reasons the electrical wiring business has generally been conducted without harmony, the result being a shocking discord of jarring interests. The large contractors have represented one element and the small contractors another, the fixture dealers a third, the Underwriters too often being regarded as the common enemy. That the Underwriters' rules are sometimes rather drastic we must admit, yet on the whole they unquestionably lead to that safe construction which in the long run is helpful to the lighting business. A brief account of the "electrical clearing house" movement in Louisville in another column shows how the interested parties in a single city have organized a

"get together" plan, and with no small measure of success are trying to bring all their varying interests into harmony. It has served to clear up misunderstandings about the interpretation of the National Electrical Code and to place the contractors in touch with inspectors in order to avoid construction which would be rejected. The scheme appears to be a good one. Not through malicious intention but by accidentally being on the wrong side of a rather shady line the average contractor may seem to ignore the code at times. A regular system of conference with more experienced contractors and with the officials who must interpret the code will serve to check many an error and save many a dollar in rejections. Such co-operation not only helps the supply business but tends to increase the central-station output. One cannot lay too much stress on the importance of making electrical energy supply a necessity, and this condition is brought the nearer by every effort that tends to promote reliable work in wiring.

Selling Appliances

Central stations have at last learned to appreciate the importance of adding to their load by conducting active appliance campaigns. Every article sold means an increase of load without any addition to the fixed charges due to billing and metering, and hence an increase in the net profit. Real success demands the sale of many appliances in order to make the domestic load thoroughly profitable in spite of modest bills for lighting alone. Introducing appliances on a large scale means active salesmanship and skilled advertising. The present issue contains some very practical hints by Mr. J. V. Guilfoyle on this subject which should be of immediate interest to all those who are inaugurating this line of enterprise. He makes some especially timely and important suggestions. One of these is in relation to the display and sale of rather undesirable stock. Not a few appliance departments, from good nature or pressure of manufacturers, carry a considerable number of articles that are by no means the best on the market, and the salesmen are too likely to lead the customer astray. Central stations do not enter the appliance business to assist needy or incompetent manufacturers but to increase their own load by placing before the consumer articles that will tempt him to use them regularly. The better the appliance, the faster the business will grow. Hence the consumer should be induced to buy only such devices as will give him the best of service.

It is important also that the appliances sold should have interchangeable connections so far as possible. In any event the salesman should not allow a customer to leave the store with an article the plug of which will probably not fit his house connections. It is perfectly simple to ascertain what connectors are needed and to furnish them even if the salesman has to make up a short length of cord with an adapter on each end. Canvassers should go armed with such little adapters and when about their work should make note of the one needed in a house. Active demonstrators in a good showroom are of the utmost importance. In the use of electrical appliances seeing is believing. An effective demonstration will often end in the sale of appliances which mere advertising would not move from the shelf. As lamp efficiencies increase the need of many and general outlets for energy becomes acute. In our judgment the appliance field will become in the near future very large and profitable, and it should be most assiduously cultivated.

Concentric Wiring and the Inspectors

Because of a program crowded with other—and some of them less pertinent—topics and discussions, the subject of concentric wiring failed to come up at the recent Minneapolis convention of the Western Association of Electrical Inspectors. The omission of so important a topic from the inspectors' councils is a distinct loss to the forum of discussion which has centered about the proposed innovation in electrical construction methods. For, after all, if concentric wiring is to be condemned or approved, its final fate will rest on its practicability and, above all, its safety, and not on any mere selfish considerations of those branches of the industry which its revolutionary results may most affect. The inspectors have long been disciples of the "safety first" idea—at almost any cost—and any public expressions of theirs concerning the hazards (if any) which they see involved in concentric construction would have been of great value to the industry at this time.

Individually, as revealed by a census taken among the delegates at the convention, the inspectors seem to be almost unanimously against encouraging approval of the new wire. Installed carefully by competent workmen, concentric wiring, as some inspectors freely admitted, "might be all right," but even these heretical gentlemen insisted that such wiring would be at best a dangerous thing, to be handled only with special tools and the greatest caution by skilled artisans. Dangers of electrolysis were touched upon during one session, and in reply to a question a government expert expressed his opinion that the local grounding of neutrals of a three-wire system would be a practice calling for condemnation on the basis of possible electrolysis troubles. Some of the inspectors were disposed to take the view that with return currents in the bare outer sheaths branch return paths might be set up at every grounded structure crossed. Electrolysis once started at such an intersection might insidiously eat away, first part and then the entire sheath, at last leaving the accidental "cross" as the only path to ground and so opening the way to all sorts of mischief. This is one side of the story.

Open discussion among men with practical field experience might score some points in favor of concentric wiring from the standpoint of safety. At any rate, the inspectors should have been "heard in meeting" on this important subject, for their protests, if plausible, will go further than any mere selfish objections raised to stay the advent of a form of construction which, from all reports, is giving satisfactory service abroad.

GRIPPER & SIDE GUIDE

How to Merchandise Electrical Appliances

The Sales Force, Display Room, Advertising and Co-operation that Central Stations Should Maintain to Win Success

BY J. V. GUILFOYLE

IN order to sell electric appliances successfully attention should be paid to creating interest in devices, demonstrating their uses and operation, pointing out their advantages and maintaining them in satisfactory operation. No less important are the selection of salesmen, provision for co-operation with other dealers, methods of purchasing, storing stock and keeping accounts.

Considering the organization of an appliance-sales department, first, it is important that the manager have sufficient authority and confidence in his ability to be independently able to select appliances that he, by close observation and analysis, finds the public can or will purchase. It is unfortunate in many organizations that through personal friendship for salesmen or manu-

FIG. 1—ILLUSTRATED CATALOG SENT TO CUSTOMERS

facturers the showrooms are heavily stocked with appliances which are many times not representative of the most efficient or most salable ones on the market. In central-station appliance-sales departments it frequently happens that the manager is forced to purchase certain articles which his superiors recommend.

Training the Sales Force

The training of the salespeople is very important. Before they should be allowed to come in contact with the shoppers either in the showroom or by calling at any prospective purchaser's house they should have thoroughly tried every appliance which is offered for sale by the company. In addition, the demonstrators should be thoroughly conversant with the uses of the appliance, its energy consumption and practicability. Armed with this information, the salespeople are in a position to perform their duties enthusiastically and to the satisfaction of the shopper.

If a purchaser sees that a salesman is enthusiastic over the device which is being demonstrated, he will usually absorb the same spirit and besides buying the appliance may interest a number of others in the use of electrical devices.

Unless proper attention is given to the cost of doing business, the net profit on sales may be very small. For any company selling from 300 to 400 articles a month it is absolutely necessary that periodical inventories be taken to determine what stock is being sold most rapidly and what articles should be more prominently featured to maintain a rapid and uniform movement of the stock. Particular attention should be paid to recording of sales and disposition of stock, as lax methods in this respect will greatly affect the ultimate profit.

Sufficient emphasis is not usually laid by the central-station company on the importance of every employee assisting in the extension of electric service. As every energy-consuming device that is connected to the electric-service company's meters means additional revenue to the company without investment for meters, lamps, service mains, etc., it should be the desire of every employee to assist in the sale of electric appliances. The regular new-business solicitors may also be helpful in securing "tips" on fields for selling new appliances, and may also recommend them to those with whom they come in contact.

Value of Advertising

One of the main avenues through which the public may be interested in the use of electric appliances is popular advertising. This can be done in a general and extensive way by the manufacturers and jobbers, by advertising in popular magazines, especially those subscribed to by women, as the women are the ones who create the demand. When properly timed with national advertising, newspaper announcements may be of assistance in stimulating the sale of electric appliances. Material and cuts for making up newspaper copy can usually be obtained from the manufacturers or jobbers.

Still further publicity can be given to appliance sales campaigns by circularizing catalogs describing and illustrating electric appliances. Special circulars containing information which may be of permanent value to the receivers may prove more valuable than regular catalogs. Such descriptive matter can be distributed through the mails or by attaching it to regular monthly bills or notices sent out by the company. The latter method is usually less expensive, but if the circulars are made up in an attractive form and sent by first-class mail they will generally receive more attention.

Importance of Display Room

In any campaign for new business the importance of making the display room attractive should not be lost sight of. Special attention should be paid to featuring some one device. In addition to being artistically deco-

GRIPPER & SIDE GUIDE

rated, the display windows should be attractively lighted. Some cards should be displayed which suggest how the articles exhibited may be of use to everybody. Tags should always be placed beside each device showing its price plainly. In some cases it may be advisable to have a few of the advantages of the appliance stated briefly on the card together with the cost of operation.

Articles should never be labeled "Don't touch" or anything that would imply the same thing. On the other hand, devices should be displayed where they are denied this right, he feels that the article is not what it is claimed to be. By allowing the articles to be handled many more are usually sold than is the case if they are placed where they can only be looked at.

UNITED
YOU ARE CORDIALLY INVITED TO INSPECT OUR INTERESTING EXHIBIT OF HOUSEHOLD COOKING AND HEATING DEVICES, DEMONSTRATING INNUMERABLE TIME AND LABOR-SAVING FEATURES.
THE UNITED ELECTRIC LIGHT & POWER CO.
SHOWROOM: 138 HAMILTON PLACE
AT WEST 145RD STREET,
AND AMSTERDAM AVE. NEW YORK
OPEN 9 A. M.
EVENINGS TILL 10 30

FIG. 2—INVITATION FOR MAILING

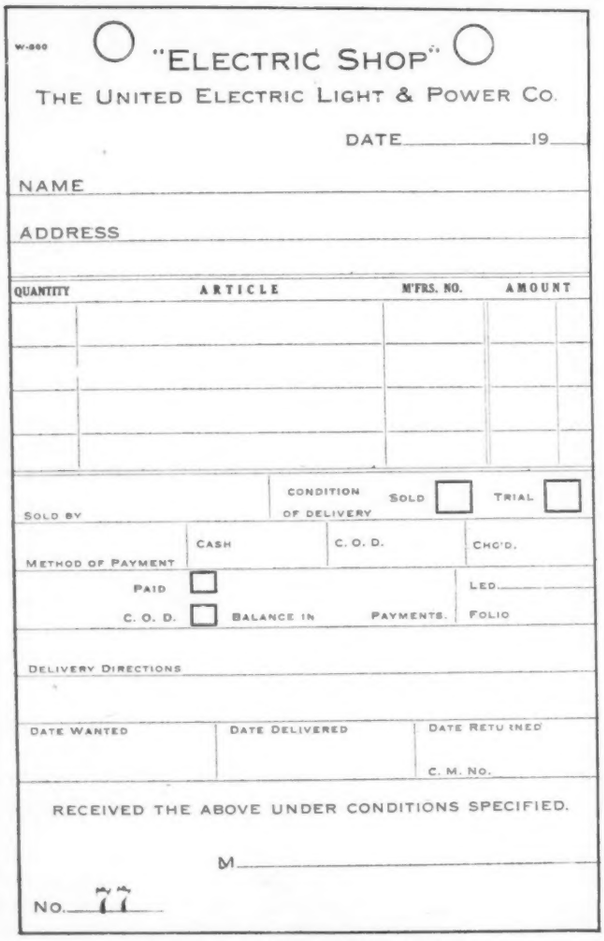


FIG. 3—SALES-RECORD FORM

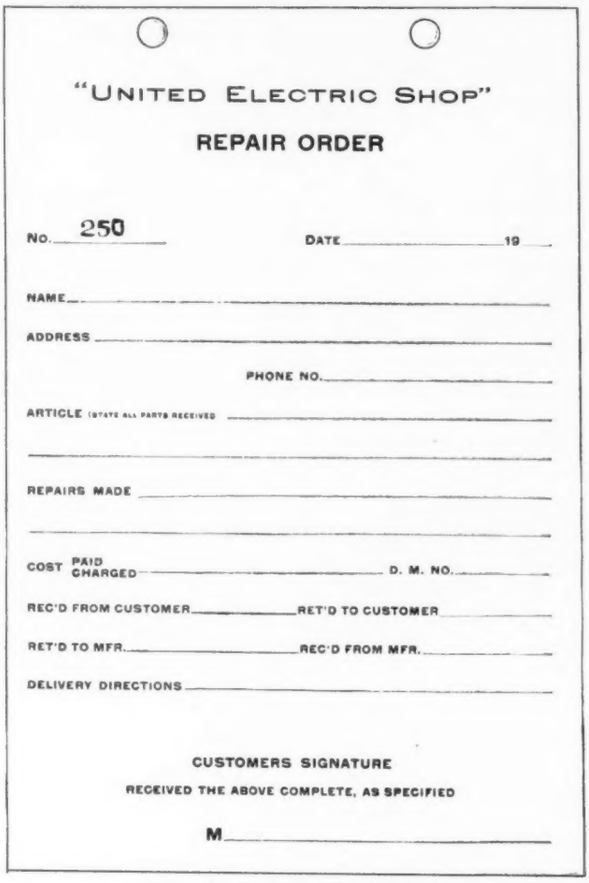


FIG. 4—REPAIR-ORDER FORM

There need be no fear of the article becoming shopworn, as persons purchasing electrical devices usually demand that they be given the device which they have handled and have found to be entirely to their satisfaction.

It is advisable to keep a record of purchasers of electrical appliances, as once they have used one they are usually more likely to buy others. Canvassing users of electrical devices to induce them to install additional devices may often result in more sales than a general

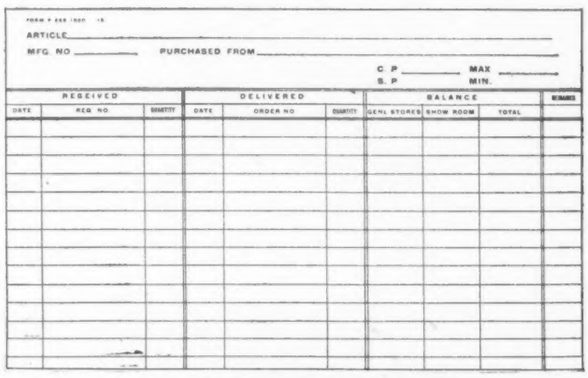


FIG. 5—STOCK-RECORD CARD

in convenient reach of any shopper who may feel tempted to purchase the article. Every shopper feels that he has the right to pick up and scrutinize the article which he will ultimately purchase. If he is canvass of persons who have no idea of the convenience of employing electrical devices.

Appliances are especially acceptable when their cords and connectors are interchangeable, allowing the use of

one service connection for each device and permitting the other connectors to be held as a reserve in case of emergency. The maximum revenue will be obtained and the customer's good will secured if the electric-service company makes it a point to repair minor defects in the appliances.

Co-operation with Dealers and Contractors

Co-operation with electrical dealers will develop friendly relation and assist in a small way in increasing the load on the electric service company's lines. Not only electrical dealers, but hardware stores, etc., each represent an additional point of distribution, as they are usually thickly scattered over all territories and will therefore call the attention of the passing public more strongly to the variety of electrical devices available.

Some dealers cannot be relied upon to handle efficient, practical, guaranteed appliances, and are incapable of doing sufficient business to warrant their being left alone as electric-appliance merchandisers. Many of them are poor merchants and keep unattractive stores and antique stock. Moreover, the average dealer will accept an electric appliance because of the price offered by the manufacturer rather than because of its salability, practicability or efficiency. It is important that the dealers should be educated, since the electric-service company's aim is, or should be, to obtain and maintain the good will of its consumers.

By selecting aggressive dealers who maintain attractive stores and attempt to please their customers electric-service companies may obtain considerable assistance in merchandising electrical appliances if they consign to these dealers a small stock of electrical appliances which can be sold at special prices. This will usually stimulate them to greater efforts and give them an opportunity to display stock that they would not otherwise be able to handle.

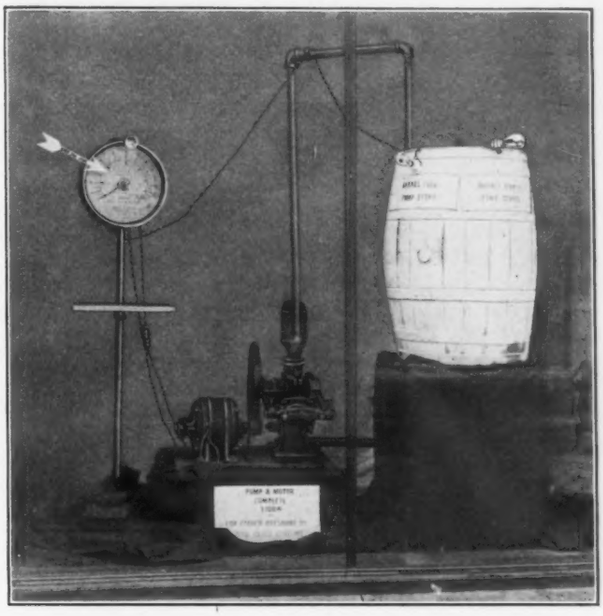
List of Seasonable Appliances

The following appliances are suggested as suitable for campaigns at the beginning of each season of the year: vacuum cleaners and fans in the early spring; flatirons in the summer; percolators and toasters in the early fall, and a variety of devices for gifts at Christmas.

Electric-service companies may do well to prepare catalogs containing illustrations and prices of approved electric appliances and send a copy to each of the dealers in their territory, with instructions that any of the articles listed therein will be furnished at a special discount in case there is a demand for it. Including the names of local dealers in advertising literature will often induce those mentioned to co-operate, and may also be the means of selling a number of appliances to people who might not feel inclined to travel so far as the electric-service company's display room.

Central-Station Window Display to Increase Pumping Load

To illustrate the simplicity, automatic control and operating cost of motor-driven pumping equipment, the Elmira (N. Y.) Water, Light & Railroad Company has been employing the window display shown in the accompanying illustration. The equipment is cleverly arranged so as to answer most of the questions which would probably be put to new-business solicitors by persons interested in pumping equipment. In the middle of the display is a very compact Goulds reciprocating water pump directly connected to a ½-hp, single-phase Wagner motor, the price complete of which is indicated below on a placard together with a statement that it can be used for either pressure or gravity-feed water systems. The water-delivery pipe leads from the pump to a barrel on the right. To show that the pump starts automatically electric lamps are attached to the barrel,

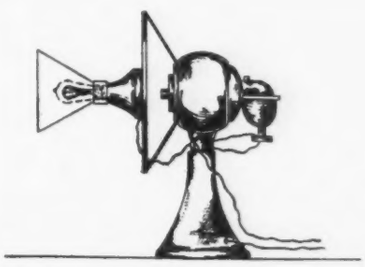


DEMONSTRATION OF AUTOMATIC ELECTRIC PUMP

one showing when it is full of water and the other indicating when it is empty. On the left of the motor is a Donkin cent-hour meter which is connected in the electrical circuit leading to the motor. A large arrow pointing to the meter dial informs persons gazing into the window that the meter indicates the cost of operating the pumping equipment in cents per hour. Lamps illuminating the meter dial also call attention to the cost of operation.

Oscillating Fan Mechanism as Window Attraction

A Minneapolis dealer in electrical supplies has adapted the oscillator mechanism of a 16-in. fan to carry a 200-watt nitrogen-filled lamp in the manner shown, making an attractive window display as the rays of the powerful lighting unit, which is set in a concentrating reflector, sweep back and forth over the sidewalk. As the blades are removed the fan mechanism runs much faster than it is ordinarily designed for, making the sweep of the headlamp sufficiently rapid to attract the attention



OSCILLATING FAN AND LAMP

of the passing public. The circular board on which the lamp is mounted is carried from the attachment bolts which would otherwise support the blade guard, but heavier strap pieces were required to hold the additional weight of the lamp, receptacle and reflector.

Doing Business on Low Overhead Expense

Electrical Contractor Able to Show Profit on a 10 per Cent Allowance by Not Competing for Work in Open Market

THE overhead expense of most electrical contractors is about 20 per cent or more. Means of reducing overhead expense without a detrimental effect on business naturally are of interest. Overhead expense is generally taken as the cost of doing business during a definite period of time, divided by the cost to the contractor of the business done during that period, the quotient being expressed in per cent. With a fixed amount of business the percentage overhead expense can be reduced only by decreasing the cost of carrying on that business, or with a fixed cost of carrying on the business the percentage overhead expense may be reduced by increasing the volume of business done. An electrical contractor should hence aim to keep his percentage overhead expense at a minimum by conducting as large a business as possible at as small a cost as possible. This is the cause for the fact that the W. B. Perry Electric Company, of Brooklyn, N. Y., is able to conduct its electrical contracting business with an overhead expense of approximately 10 per cent.

Details of Business

No discussion of overhead expense is of value unless those factors which enter into its computation and the means of applying the overhead expense are given. The company under discussion applies its overhead expense as a certain percentage to the estimated cost of a given installation. The items which are taken into account in computing the overhead expense to be employed are given in the following outline:

- Liability insurance.
- Heat, light, water and telephone.
- Stationery and postage.
- Rent of building.
- Salaries of office force.
- Entertaining.
- Losses:
  - Bad accounts.
  - Breakage.
  - Attorney's fees.
  - Allowance on bills.
- Automobile:
  - Operating and upkeep expense.
  - Depreciation.
  - Interest on investment.
- Depreciation of office furniture and fittings at 5 per cent.
- Depreciation, loss and waste of stock and tools.

No allowance is made for interest on the investment, but such an allowance could be made without exceeding the allowance of 10 per cent for overhead expense.

The Perry Electric Company does business on both the percentage and straight-contract basis. In the former case the overhead expense is taken as 10 per cent of the actual cost of the work and in the latter case as 10 per cent of the estimated cost of the work. In both cases 20 per cent is added to the actual or estimated cost of the work as profit. The average gross amount of business done by the company is about $180,000 annually.

The company does not specialize in any particular branch of the electrical contracting business but will accept contracts varying from the wiring of a cottage to installations costing as much as $160,000.

The office and stockrooms of the company are at 292 Livingston Street, which may be considered as a comparatively desirable location from which to conduct such a business. Both the office and stockrooms are on the first floor of the building, and a show window can be taken advantage of for displays. In addition to Mr. Perry, the office force consists of an accountant, a general superintendent, a combined superintendent and estimator, a stenographer and a stockroom boy. All soliciting is done by the men composing the office force.

This office force may at first appear inadequate for the amount of business done. However, by carefully distributing the work and maintaining system in everything a great amount of supervision is unnecessary. The entire organization is so controlled as to eliminate all unnecessary details, but at the same time the office force is in possession of all the details of all work under way.

Estimating, Cost Keeping and Other Forms Employed

The accompanying illustrations show some of the forms employed by this firm. At the present time the firm uses a special estimate sheet, but it will employ

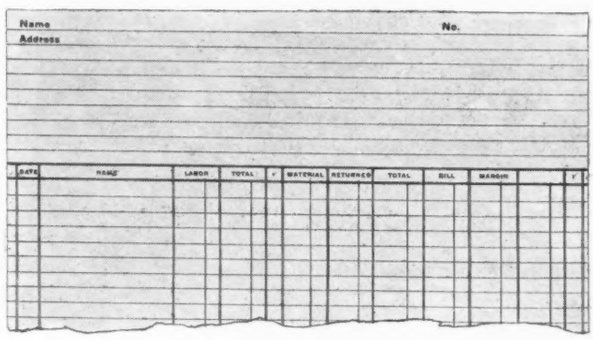


FIG. 1—COST-KEEPING FORM

those published by the National Electrical Contractors' Association as soon as the present stock is exhausted. The workmen are required to turn in daily time and material vouchers. The vouchers are employed in making entries on the cost-keeping forms, one of which is shown in Fig. 1. Separate columns are provided for entering all labor and material costs and for giving credits for returned materials. A trial balance of the books is taken every month. Some idea of the manner in which this is done can be obtained from the form shown in Fig. 2. The labor and material charges for each contract under way are carried over from the preceding months, and all new charges for labor and material are entered. Where work is being done on a straight-contract basis the profit or loss on each job as compared with the estimate is computed. These sheets are kept in a loose-leaf ledger.

Fig. 3 shows a daily time sheet which is now being employed by the company on large work. It is intended that all the electricians and their helpers on any one contract shall indicate on this sheet the number of hours spent on the job and the amount of work done. Columns are provided in which to give the amounts of various materials installed. A wide column is also provided for any materials not named. This sheet is being employed not only as a means for checking estimates with

the actual amounts of labor required but also as a means of comparing one man's work with another's and to bring to the attention of every man the relative quantity of work which he is doing from day to day. On small work extending over a period of only a week or ten days at the most these elaborate time sheets are not employed, but instead small cards are used.

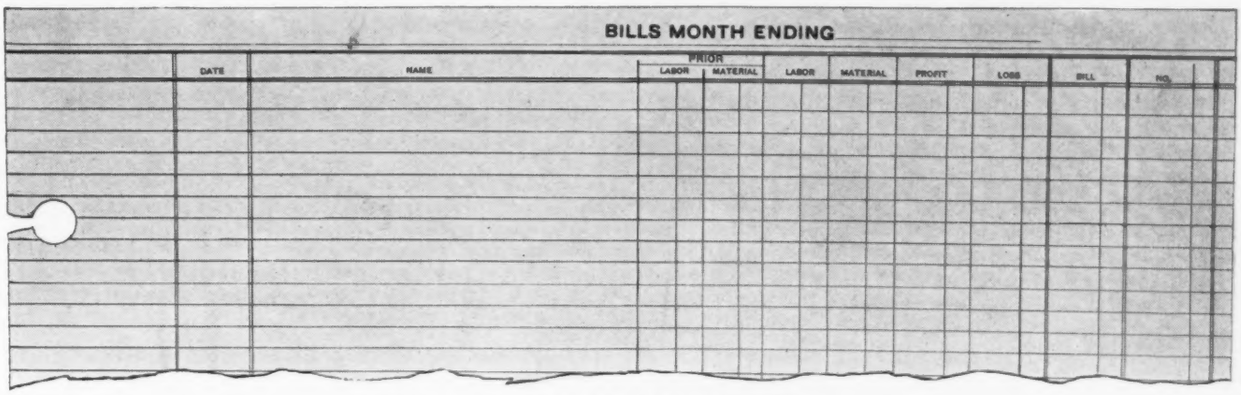
All blueprints of installations are kept permanently and hence can be used for reference in case any additions or alterations are later desired. When a contract is completed the blueprints for the work are all numbered and filed, the number assigned to the blueprints for the job being placed on the files, where it can be readily found. For each job a cardboard letter folder is maintained in which all correspondence is filed as well as a copy of the original estimate and proposal. These are all kept in a separate file until the work is completed, when they are transferred to a file of completed jobs and filed away together with the other information on the work. The daily time slips and material vouchers as well as the original estimates and proposals are all retained.

It is thus seen that system is maintained throughout the office. In this way much labor is saved. One bookkeeper can easily handle all the necessary bookkeeping. In estimating use is made of the adding machine and the slide rule, the latter being a labor-saving device the value of which many contractors do not realize.

Methods Employed

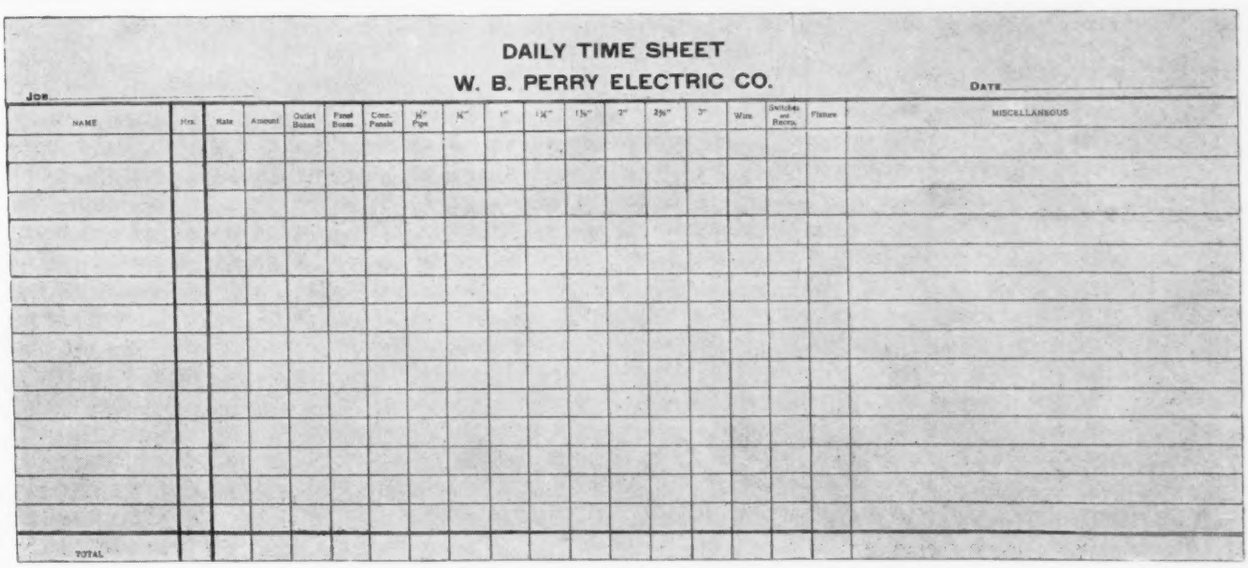
One of the reasons why this company can carry on its business with an overhead expense of only 10 per cent is that it does not solicit business in the open market as much as it does among private clients. In this way the company saves the time and effort which many contractors put forth in attempting to obtain business which is very likely to go to the lowest "curbstoner." By bidding only on such work as permits of a first-class installation at a fair price the company saves much unnecessary expense. The company also aims to maintain permanent clients by giving them first-class work in all cases.

Much of the firm's work is done on the percentage basis as previously mentioned, 10 per cent being allowed for overhead and 20 per cent for profit. This firm finds that this method of doing business is very desirable, especially where the customer is an old one and one who knows the policies of the firm. In order to obtain and retain the confidence of its customers on the percentage basis, the firm's books are always open for inspection. The prices given a customer on material are the same as those obtained by the firm in buying. Where material has to be ordered for a contract the manufacturer's invoices accompany the bill when rendered. No work will be undertaken on either the percentage or straight-contract system unless provision is made for 10 per cent overhead and 20 per cent profit. The firm confines


BILLS MONTH ENDING

	DATE	NAME	PRIOR LABOR	PRIOR MATERIAL	LABOR	MATERIAL	PROFIT	LOSS	BILL	NO.

FIG. 2—SAMPLE OF SIMPLE LEDGER SHEET


DAILY TIME SHEET

W. B. PERRY ELECTRIC CO.

Job Date

NAME	Hrs.	Rate	Amount	Outlet Boxes	Panel Boxes	Conc. Panels	¾" Pipe	¾"	1"	1¼"	1½"	2"	2½"	3"	Wire	Switches and Panels	Fixture	MISCELLANEOUS
TOTAL																		

FIG. 3—DAILY TIME SHEET USED FOR LARGE WORK

its principal efforts to the soliciting of business in the borough of Brooklyn, but does considerable work also in cities throughout the country.

No large stock of materials is maintained, as the company finds that, owing to the fact that all of its business is not confined to the borough of Brooklyn, the expense of maintaining a large stock and transporting materials from its stockroom is greater than the transportation charges when buying materials from the manufacturer, even though quantity discounts are generally allowed in buying large quantities of materials. In placing orders for materials, the company invites quotations from first-class manufacturers and awards the contract to the lowest bidder, no attempt being made to obtain materials at reduced cost by pitting one manufacturer against another. Very little material is bought through jobbers.

All work is estimated by the estimator and the closing of the contract handled by the estimator or Mr. Perry. After a contract is closed, the orders for materials are placed and all material is delivered on the job before any men are sent on the work. All work is done under the personal supervision of the general superintendent and the combined superintendent and estimator.

In cases where the arrangement of circuits, outlets, etc., are not given by the architects or engineers on the plans, an electrical layout is made by the firm whether required by the architect or not. One of the advantages of making plans for all installations is that less material and time is required than if the method of running the circuits, etc., were left to the judgment of the workmen. In addition, it permits a permanent record of the installation to be made. Alterations and additions can hence be made at any time at a minimum expense. Where work is being carried on in some distant town the advantages of having blueprints of such installations under way are obvious. Where additional outlets are to be provided or changes made in the original layout there is no necessity for communicating with the men on the job in order to learn how the circuits are actually laid out.

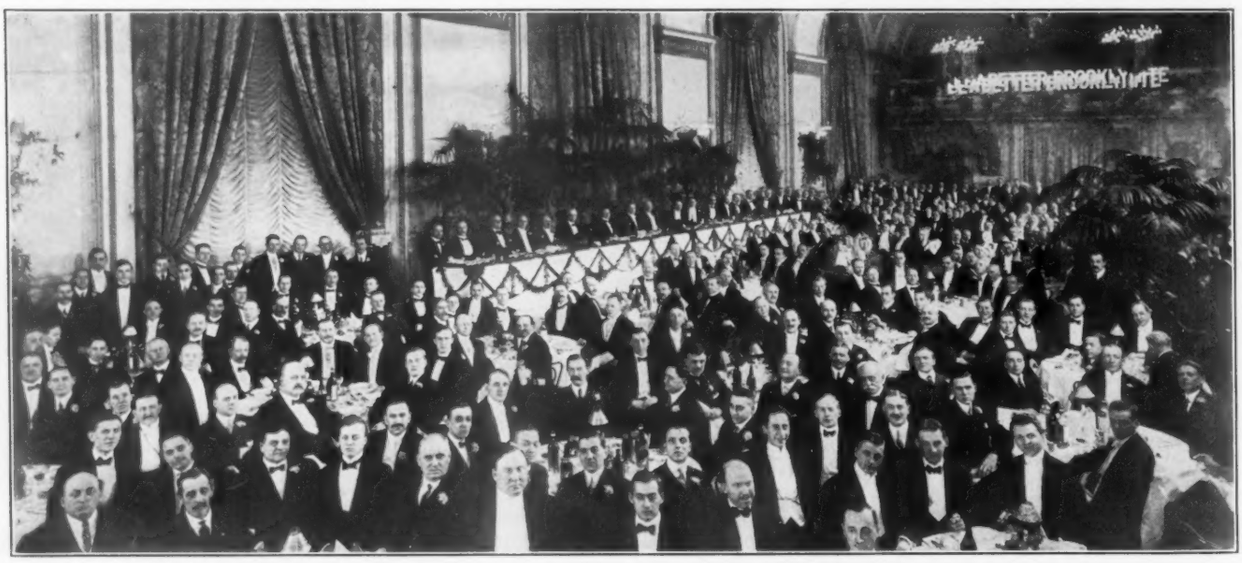
It may hence be said that the reasons why the overhead expense of this firm is only about 10 per cent are, first, that it employs a cost-keeping system which requires a minimum amount of work; second, that the office force is so organized and its work so systematized that no unnecessary duplicating of work takes place; third, that the firm does not attempt to obtain every contract in sight but confines its efforts to those proposed installations which it knows are to be made in a first-class manner and for which a fair price will be allowed; fourth, that the firm aims to give all clients good work and thus retain them as permanent clients; fifth, that much of the firm's work is performed on the percentage basis, thereby eliminating much of the uncertainty of the straight-contract method of doing business; sixth, that system is maintained in everything, no work being started until all material is on hand and until the plans are made for the work, and seventh, that constant check is maintained on the performance of the men and on the amounts of materials used.

HAND IN HAND WITH CONTRACTORS

How the Brooklyn Edison Company Co-operates with Dealers and Contractors in the Use of Electricity

As published in these columns last week, the ninth annual dinner to the electrical contractors of Brooklyn by the Edison Electric Illuminating Company of that city was given in the Academy of Music on Feb. 10. This is only one of the manifestations of good will existing between the company and the contractors.

All of the electrical interests of the borough are brought into very intimate touch through the Kilowatt Club, a local organization of electrical contractors. It was in collaboration with this organization that prices mutually satisfactory to the company and the electrical contractor were agreed on for the new house-wiring plan of the Edison Electric Illuminating Company. This plan, which has already been described in these columns, provides flat prices for wiring each different room in any residence and for all features of equipment, so that the householder himself can compute in five or ten minutes exactly what it will cost him to wire one room or his entire house. The company itself does not do any wiring, but apportions the contracts received among the contractors of the borough, giving consideration to customers' preferences and to local conditions.



ELECTRICAL CONTRACTORS OF BROOKLYN, GUESTS OF BROOKLYN EDISON COMPANY

The monthly sales of appliances held by the company are advertised through post cards inclosed with all bills to customers and also by billboard and newspaper publicity. Contractors and supply houses are notified of these sales and are permitted to share in the benefit of

the advertising, the company supplying to them the article on sale at a price which will yield a liberal profit.

Throughout the borough arrangements are made with contractors to receive application for electric service. The windows of such contractors are painted with a sign, "Edison Light & Power. Applications Received Here," and the windows are lighted for the contractor at night by the company without charge. The harmonious relationship thus existing between all branches of the electrical industry of the borough of Brooklyn has worked out well for the benefit of all concerned, and especially for the benefit of the local lighting company.

Advertising Electricity to Manufacturers

Campaign Adopted by the Cleveland Electric Illuminating Company to Keep the Power Question Before Factory Owners and to Back Up Its Solicitors

THE most effective advertising done by the Cleveland (Ohio) Electric Illuminating Company in recent years has been the publication of a series of interviews with some of its own customers. The company appreciates that power advertising has got to be specific in order to appeal to the manufacturers. The latter, who are fairly familiar with the general advantage of central-station service, are more deeply interested in knowing what competitors are doing and what are the experiences of other users of electricity in their own or similar lines of business.

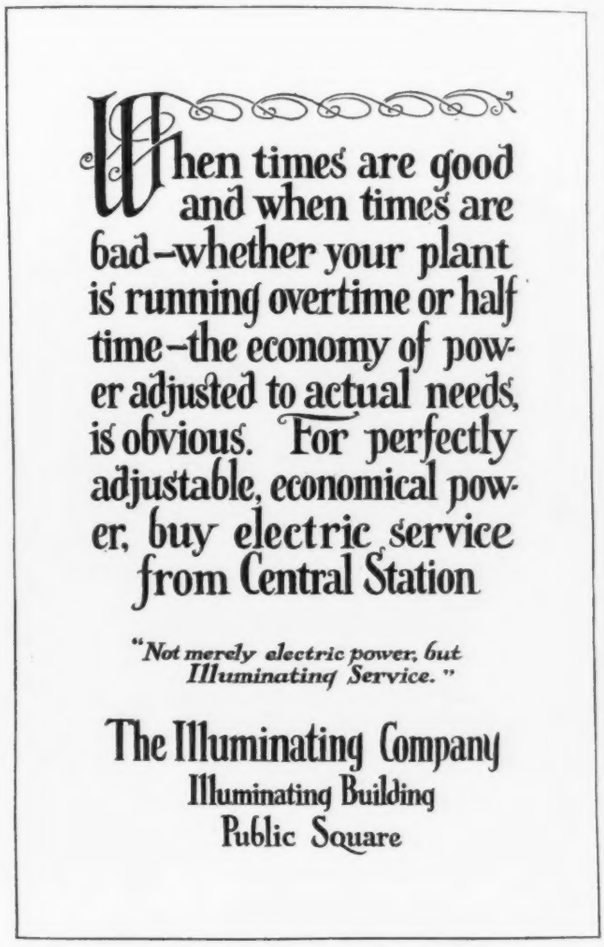

When times are good and when times are bad—whether your plant is running overtime or half time—the economy of power adjusted to actual needs, is obvious. For perfectly adjustable, economical power, buy electric service from Central Station
"Not merely electric power, but Illuminating Service."
The Illuminating Company
Illuminating Building
Public Square

FIG. 1—ADVERTISEMENT OF CLEVELAND ELECTRIC ILLUMINATING COMPANY

The interviews used by the company in the campaign dealt with individual experiences described in some detail. These gave the testimony of users regarding the service of the company and the comparative saving in space and investment possible thereby, together with the peculiar advantages of buying rather than making electricity for the industry in question. The interviews were divided among classes of industry canvassed by the company. For instance, if solicitors were calling upon a brick manufacturer interviews were obtained from brick manufacturers on the company's line and published in the newspapers. If the solicitors were working on an iron foundry, testimony from some iron founders using central-station service was obtained.

It should be pointed out that the company did not employ its own staff in getting these interviews, but, feeling that customers would be inclined to talk more freely to outsiders, men having no connection with the company whatsoever were employed for that purpose. In order that the testimony might carry conviction, the names of the parties interviewed were published in all of the advertisements. An attractive booklet of these testimonials was printed and widely distributed among the manufacturers of Cleveland who were not

The Growing Factory Needs Central Station Power
NO private power plant can economically keep pace with a rapidly expanding factory. Money must either be invested in a plant whose capacity is greatly in excess of present needs, or spent in constant additions to the power equipment.
Central Station furnishes just the power you need now, and can supply all the power you will need in the future. The private plant means breakdowns, delays, power loss, heavy investment, with big items of interest and depreciation, fuel and labor bills, worry and uncertainty. Central Station power is reliable; it is efficient; and its cost is based on the power used.
Hundreds of Cleveland manufacturers have installed Central Station power to cut down production costs. Ask any of them what they think of it.
"Not Merely Electric Power but Illuminating Service"
THE ILLUMINATING COMPANY
Illuminating Building, Public Square

FIG. 2—ADVERTISEMENT OF CLEVELAND ELECTRIC ILLUMINATING COMPANY

users of central-station service. In addition, engineers, factory superintendents and foremen received copies inasmuch as these men are always more or less influential in questions of motor installations.

Campaign in Detail

The campaign laid out included a series of letters which were sent to prospective customers who had already been called on by the solicitors of the company. Each letter was typewritten on the company's regular letterhead and signed by the solicitor having the matter in charge. The series of letters is shown herewith in connection with the booklet containing the testimonials. The first letter attempts to impress the reader with the immensity of central-station development along the lines of motor service as a proof that the principle is right. The idea was localized by bringing out that Cleveland has had its full share of this development. The second letter dwelt on the increasing cost of all power-plant items and on the decreasing cost of "illuminating service," and the reason for it. The third letter points to the success of selling central-station service during 1912 and 1913 as a proof that the company's proposition is right. It was suggested that the company make an estimate of the cost of service for the person to whom the letter was directed.

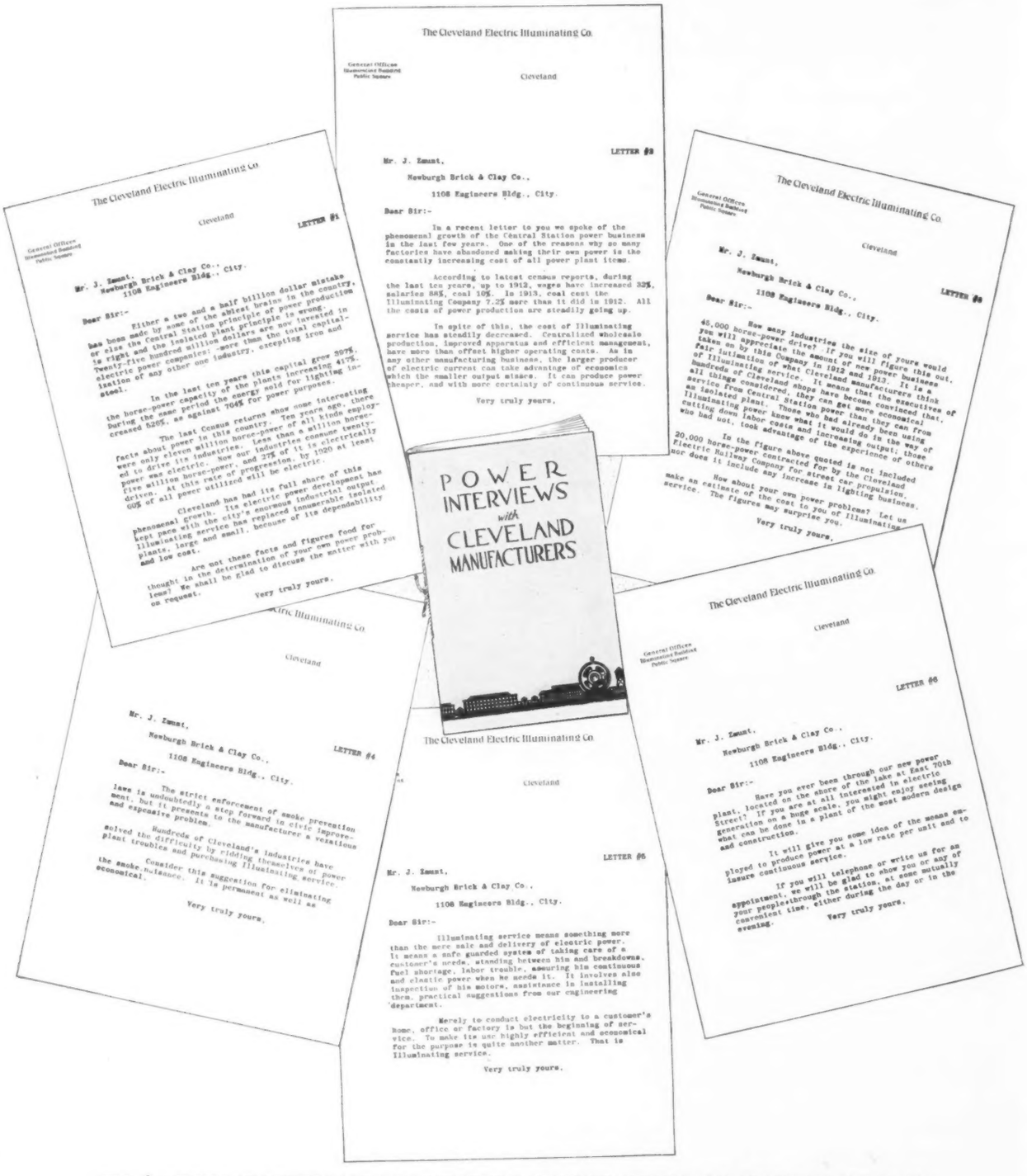


FIG. 3—SERIES OF LETTERS AND BOOKLET SENT TO FACTORY OWNERS AND OTHERS IN CLEVELAND

The fact that the smoke problem could be most economically solved by the use of central-station service

was brought out in the fourth letter. In the fifth letter an attempt was made to impress the reader with the fact that central-station service means more than simply conducting electricity to his place of business. Several phases of service were mentioned, and in the sixth letter an offer was extended to the manufacturer to visit the company's main generating station.

The introduction of the booklet, "Power Interviews with Cleveland Manufacturers," gave briefly the salient points of the interviews, together with the names of the manufacturers making the statements. General publicity work in the newspapers was started with several general advertisements on the advantages of central-station service. These announcements were followed by an advertisement calling attention to the widespread system of the illuminating company. In a subsequent advertisement not only was the extensiveness of the central-station system dwelt on but it was shown how lines were duplicated in order to insure continuity of service. The point was then made that this was not the work of a day but the work of years.

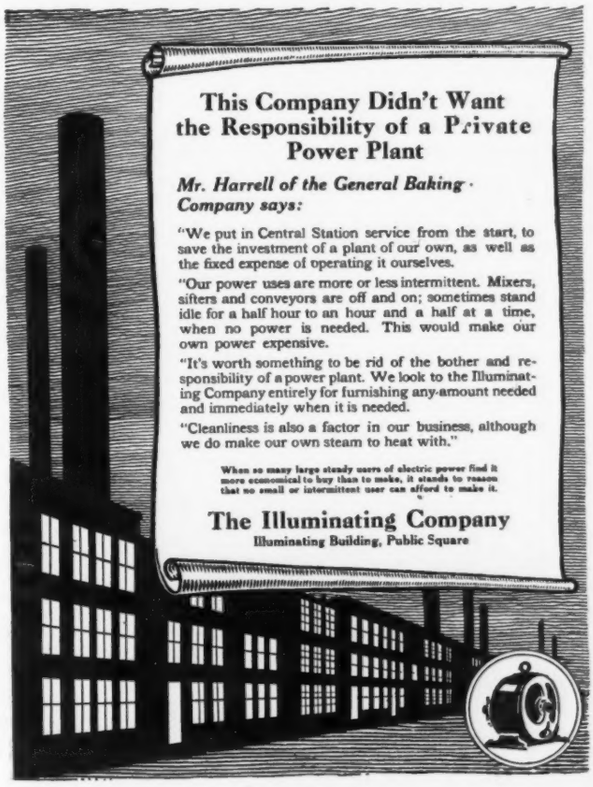
The interviews used in the newspaper advertisements specify specific arguments for central-station service for industrial purposes. Thus one manufacturer used the service because it relieved him of the bother and responsibility of looking after a private plant. Another found that the elasticity of the service was the most important point which appealed to him.

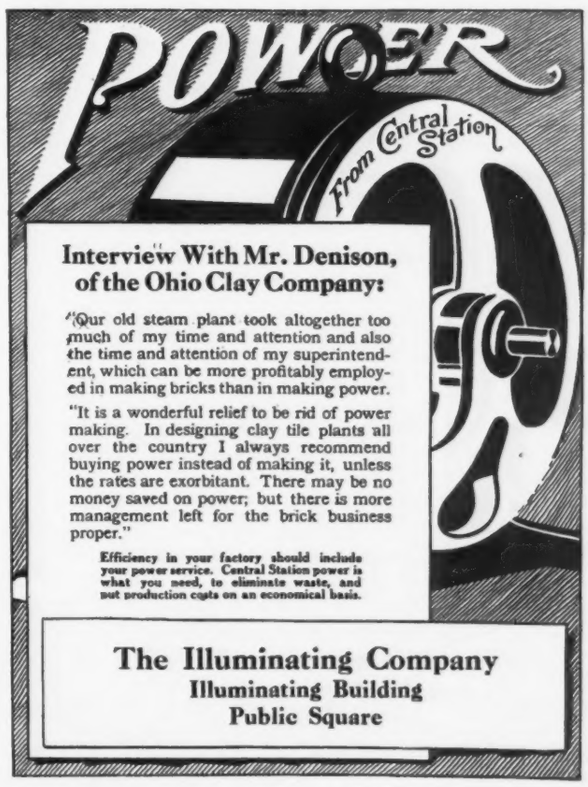
One manufacturer showed the economy of using central-station service as opposed to the use of an isolated plant, and the argument was all the stronger inasmuch as it came from the buyer instead of the seller of the service. An advantage pointed out by another manufacturer is the saving of capital possible, especially when starting business, in using central-station service, while others concede that it is more profitable for them to use electricity in their manufacturing processes than any other form of energy.

It will, of course, be appreciated that advertising like that shown herewith, appeals only to a very limited number in any community, and that the response to the appeal is not as immediate as the response to advertisements on appliances or on wiring campaigns. Much of it must be looked upon as purely educational in character, the seed sown bearing fruit oftentimes many years later.

Power Which Is Elastic and Cheap
MR. J. H. FOSTER of the HYDRAULIC PRESSED STEEL CO. Says:
"The beauty of Illuminating service is its elasticity. If we had built a plant of our own from the start, it would have had to be torn down and doubled in capacity at least every year of the seven we have been in business. We have grown so fast. This would have involved great expense and a lot of bother to us.
"Now we merely notify the Illuminating Company whenever a new machine goes in, and the additional power is on the switchboard before the machine or motor has been installed.
"A plant of our own would not do in our present state of growth, and if we stopped growing, there would still be weighty reasons for not having it.
"Theoretically, an isolated plant sounds good; practically, it works out about 33⅓% of theoretical efficiency; and there is nothing in that.
"Isolated plant sellers figure their costs under ideal conditions of load and operation. They overlook the shut downs for inventory and the half or quarter running. They forget about taxes and space and inefficient help. The man who figures seven-eighths of a cent had better raise it to 3c, to include all the actual items of expense.
"If we needed a thousand horse power and were building our own plant, we would install 2,000 horse power, to assure continuous service and leave some room for growth. This would involve an excessive investment and double the space needed.
"Many a manufacturer fools himself about the cost of making power; sometimes he does not even figure normal depreciation. Fixed charges are a much larger item in actual experience than the running cost for fuel, help, oil, etc."
The elasticity of Central Station power is just as economical in times of contraction as it is in times of expansion. Cost follows output.
"Not merely electric power, but Illuminating Service."
THE ILLUMINATING COMPANY
Illuminating Bldg., Public Square

FIG. 5—ADVERTISING THE ELASTICITY OF CENTRAL-STATION SERVICE


This Company Didn't Want the Responsibility of a Private Power Plant
Mr. Harrell of the General Baking Company says:
"We put in Central Station service from the start, to save the investment of a plant of our own, as well as the fixed expense of operating it ourselves.
"Our power uses are more or less intermittent. Mixers, sifters and conveyors are off and on; sometimes stand idle for a half hour to an hour and a half at a time, when no power is needed. This would make our own power expensive.
"It's worth something to be rid of the bother and responsibility of a power plant. We look to the Illuminating Company entirely for furnishing any amount needed and immediately when it is needed.
"Cleanliness is also a factor in our business, although we do make our own steam to heat with."
When so many large steady users of electric power find it more economical to buy than to make, it stands to reason that no small or intermittent user can afford to make it.
The Illuminating Company
Illuminating Building, Public Square


POWER
From Central Station
Interview With Mr. Denison, of the Ohio Clay Company:
"Our old steam plant took altogether too much of my time and attention and also the time and attention of my superintendent, which can be more profitably employed in making bricks than in making power.
"It is a wonderful relief to be rid of power making. In designing clay tile plants all over the country I always recommend buying power instead of making it, unless the rates are exorbitant. There may be no money saved on power; but there is more management left for the brick business proper."
Efficiency in your factory should include your power service. Central Station power is what you need, to eliminate waste, and put production costs on an economical basis.
The Illuminating Company
Illuminating Building
Public Square

FIGS. 4 AND 6—ADVERTISEMENTS OF CLEVELAND ELECTRIC ILLUMINATING COMPANY IN ITS POWER CAMPAIGN, MADE UP OF TESTIMONIALS FROM ACTUAL USERS OF ITS SERVICE

Merchandising Methods

Price-Cutting

The effect of price-cutting was the subject of a recent conversation in which a well-known electrical manufacturer said in effect:

"It starts this way. A salesman connected with a well-established manufacturer becomes imbued with the idea that he, too, could be a successful producer and distributer. He secures financial backing and starts a business. Having been a salesman and knowing little of shop methods or costs, proper accounting, overhead charges and depreciation, he begins to believe thoroughly what he had, perhaps, already suspected as salesman, that the established manufacturers are overcharging. In reality they are making but a fair and reasonable profit. However, the salesman-manufacturer immediately cuts prices, and thus he forces others to do the same.

"It becomes necessary to borrow money. The banks, seeing that the young concern is thriving, make the loan. The borrowed money adds impetus for a time, and in an effort to increase sales prices are reduced still further. The former salesman fails to see, however, that his lack of financial success is due to low prices, and things go from bad to worse. When the company fails, owing money to the bank, there is a loss of capital, the ruinous price-cutting competition has driven the price of a standard product below that which should be charged for it rightfully, and a failure has been recorded, making it doubly difficult for an experienced manufacturer to secure financial aid for the manufacture of a similar product.

"Because the electrical industry is comparatively new and there is a popular clamor for cheaper products, price-cutting has been adopted too often to boom sales. With correct cost accounting and depreciation charges, price-cutting should be even less frequent, for invariably it has been found that the man who cuts prices does not know what his product really costs."

An Example of Jobbing-House Sales Efficiency

An electrical contractor who had been asked to be one of the speakers at the annual contractors' convention in his state was at a loss for a subject on which to talk. Quite naturally he asked the other electrical men he knew if they could suggest an appropriate topic. In one voice they said, "Sure! Jump on the jobber."

Unfortunately, many persons in the electrical business believe the position of the jobber in the electrical field is more or less precarious, and that anyone to gain popular favor has only to declaim against the jobber as frequently and with as much gusto as occasion permits. Hence it is not surprising that these men advise the contractors to deride the jobbers. But incidents occur continually which demonstrate the efficiency of the sales force of the jobber and which show that the jobber performs a real service to the industry. One of these incidents, which is familiar to most electrical men, occurred in connection with the marketing of the new type of flash-lamp using a standard-sized dry cell. From the time this type of lamp was first manufactured for sale until it was to be found in practically every part of the country was approximately ninety days. This example was used by Mr. H. P. Andrae, of Milwaukee, to demonstrate the fact that a new article can be widely distributed in a very much shorter time through the electrical jobbing houses than by any other method.

One Credit Man's Maxim

Posted in the private office of the assistant treasurer of a large central-station organization in Minnesota—the official who passes upon credit matters for the company—is the following legend:

"CREDIT

"Credit is like a looking glass, which when once sullied by a breath may be wiped clean again, but if once cracked can never be repaired."

Business Ethics for the Electrical Jobber

Mr. W. E. Robertson, of Buffalo, N. Y., one of the best-known electrical jobbers in the country and a past-Jupiter of the Jovian order, has prepared for the *Reminder*, the monthly publication sent to all members of the Electrical Supply Jobbers' Association, the following ideas on business ethics, which he defines as "a standard of conduct constantly progressing in an upward direction with the increased intelligence of the most progressive and far-seeing individuals connected with a given industry":

"The purpose of having a standard of conduct is the elimination of the bitterness which follows sharp practice where no standard exists, the protection of the interests of those who, through long experience and valuable service rendered, have gained a position of influence and honor in an industry, and the guidance from pitfalls of those individuals just entering a business whose impulses are in the right direction but whose limited experience is their greatest handicap.

"The standards of conduct, or so-called ethics, are the result of experience.

"One of the most difficult things to pass on to others is the knowledge gained by experience. The hope of those engaged in all of the professions, as well as in well-established lines of business, and who preach and support the creation of ethical standards, is that by so doing an atmosphere may be created that in time will become incorporated into the business or profession itself and so raise the business or profession in its finer characteristics as to attract to it men and women of education, energy and refinement.

"In choosing a business or profession it is not enough that an opportunity to make money exists in it, but with the opportunity should come the commendation and regard of the community.

"To illustrate: Few men of education and even slight culture would select as a business for a son that of the pawnbroker or saloon-keeper. There is money to be made in these pursuits, but the accepted ethics of each is so low that instead of those pursuing these industries receiving the commendation of the community they receive its condemnation.

"The electrical supply business, being young, has not as yet a clearly defined standard of ethics.

"We are gradually accepting the fact that service rendered to the public is the justification for a satisfactory margin of net profit. We are gradually coming to the conclusion that misrepresentation and sharp practices akin to it make an unsound foundation on which to rely for the erection of a permanent and profitable business. We are gradually seeing that in running down a competitor and belittling his integrity and ability to serve we not only lower ourselves but the industry of which we are a part.

"We are beginning to realize that others as well as ourselves have aspirations not only for the industry but for themselves, and that the enrichment that comes through the courtesy, kindness and thoughtfulness of others is something to be highly desired.

"In striving for the establishment of a code of business ethics applicable to our business, to the end that with the opportunity for profit there shall also be an opportunity for culture, we must be patient and must take philosophically our disappointments, realizing that our personal ideals keep pace with increasing experience and growth, constantly widening the gulf between the man of mature years and those who are but entering the industry.

"To strive for the attainment of the ideal is the inspiration of all continued effort on the part of the individual. When hope of attainment is lost life becomes at best a dreary existence. So, in the hope that we are gradually, as an industry, establishing a code of business ethics that shall uplift and increase the attractiveness of our business, let us hold fast to a happy optimism, welcoming the aid of those who aspire to like ideals, regarding with broadest charity those who fail to comprehend, and with thanks for progress achieved hold fast with sweet philosophy to the things most cherished by each of us."

How an Electric-Range Campaign Started in Buffalo

About eighteen months ago a down-town apartment hotel to contain ninety-five small suites of three and five rooms each was projected in Buffalo. The plans originally called for an isolated steam plant, and the owner apparently desired nothing else. However, when he was informed by a representative of the Buffalo General Electric Company of the many advantages of central-station service, his reply was characteristic of the modern business man. He said, "Show me." The plans were then carefully gone over and the following suggestions were made: Heat with low-pressure steam; install motor-driven refrigerating apparatus; heat water by automatic natural gas heater; light electrically; supply your tenants with electric ranges.

The owner was broad-gaged enough to appreciate the advantages of the first four recommendations, but hesitated considerably at the fifth. He was prevailed upon, however, to install an electric range in his own home on a trial of sixty days. At the end of one year both the owner, Mr. G. H. Poppenberg, and his brother had tried electric ranges and were such enthusiastic advocates of cooking by electricity that thirty 2.64-kw ranges and sixty-five 3.4-kw ranges were ordered for this installation. These stoves, which were made by the Standard Electric Stove Company, of Toledo, Ohio, represent a connected load of 300 kw, and it is notable that they were installed in spite of the fact that natural gas which sells at 30 cents per 1000 cu. ft. is available at the site of this building.

The owner purchases electricity at a wholesale rate from the central station through one meter and will install in each apartment a sub-meter of his own, agreeing to supply the tenants with electric light and service for electric cooking at rates less than the consumer could obtain as an individual customer of the central-station company.

The low-pressure steam plant for heating is equipped with smoke consumers and has a vacuum return system which will permit even temperatures to be maintained throughout the apartments. Each apartment is equipped with "built-in" refrigerators of porcelain. These are cooled by an automatic, electrically driven, 20-ton refrigerating machine made by the Hartford Automatic Company. All water supplied to the apartments is filtered twice through quartz and is pumped electrically to large tanks at the top of the building. The ventilating system, which is electrically driven, and two Otis electric elevators of the most modern design complete the electrical equipment of this thoroughly up-to-date apartment house.

Mr. F. A. Coupal, sales manager of the Buffalo General Electric Company, in speaking of this remarkable installation, said that since the closing of this contract three owners of smaller apartments are seriously considering replacing their gas stoves with electric ranges.

Helpful Information Given to Solicitors

Part of an appliance solicitor's job is to "size up" his prospective customer so that he may be guided in his talk by this estimate, and then he will neither waste time trying to sell a chafing dish to a frugal housewife nor undersell some person who is an enthusiastic user of electricity. During an appliance campaign in Toledo, Ohio, in which a house-to-house canvass was made, it was suggested that if solicitors were supplied with a list showing the amount of customers' bills for the two months previous to the campaign the data would aid them in sizing up "prospects." With this information in hand, the solicitor, it was thought, would be better able to form a correct estimate of prospective customers than by merely observing the character of the residence of the customer and the customer's general appearance, such criteria having often proved far from reliable.

15,400 Lamp-Socket Appliances Sold by Byllesby Companies and Co-operating Dealers

Reports from all Byllesby properties show that a total of 15,400 lamp-socket appliances were sold by various companies and co-operating dealers during the last holiday campaign. These appliances represent an added connected load of 6803 kw, about two and one-half times that which was obtained during the corresponding period in 1913.

The largest increase in sales above last year's records was obtained at Louisville, Ky., where 3874 appliances were sold as compared with 467 in 1913. Many of the smaller companies also did considerably better than last year, Enid, Okla., showing an increase of about 4.2 per cent, Dallas, Ore., about 3.6 per cent, Galena, Ill., 3.1 per cent. Two companies, one at Grand Forks, N. D., and another at Corvallis, Ore., which sold no appliances last year reported good sales this year.

Selling Five Suction Sweepers a Day at Toledo

Three "whirlwind" campaigns conducted by the Toledo (Ohio) Railways & Light Company in 1914 resulted in the sale of 850, 425 and 350 vacuum cleaners in the months of January, March and June respectively. Throughout the entire year the average sale of these devices was about five each day, and at even as late a date as Jan. 1, 1915, the sales force was disposing of three cleaners a day on the average. Much of the success enjoyed by the company in the sale of these appliances was, according to Mr. A. K. Young, new-business manager, due to the "personal" letters mailed above the signatures of solicitors who had some acquaintance with the prospective customers. The personal letters used were really form letters furnished to solicitors in lots of 100 each. Only a part of each solicitor's territory was circularized at any one time, and in this way each man was able to follow up inquiries on cleaners and to attend to his other duties as well.

Central-Station Sale of Ornamental Lamp-Posts

In a special effort to bring before merchants, clubs, banks, churches and theaters the advantages of using ornamental lamp-posts for exterior illumination the Edison Electric Illuminating Company of Brooklyn is offering, during February only, 300 posts erected complete and ready to light for $48 each. This amount can be paid

TRADE FOLLOWS THE LIGHT
$48 Per Post Complete
$8.00 DOWN
LAST FEW DAYS FEBRUARY SALE
$10. A MONTH
Excellent Advertising
BRIGHTER
DECORATIVE
Four lamps lighted from dusk to midnight, one lamp from dusk to dawn every night, including Sundays, for $6.50 a month.
Economical Advertising
BROOKLYN
LAMP POSTS
Think this over! Compare the attractive publicity secured, with the amount of other types of advertising obtainable for this sum.
LIGHT ATTRACTS—DRAWS TRADE
Write or telephone nearest Edison office. Representative will call at once.
Edison Electric Illuminating Company of Brooklyn
360 PEARL STREET
Telephone Main 8000 (Connecting all Branches)

ADVERTISEMENT USED IN POST CAMPAIGN

in instalments if desired, $8 at the time of signing the contract and $10 on each of the succeeding four months. This offer is open to any individual or organization occupying premises along the company's electric-service mains. The company is pointing out through literature advertising the campaign that progressive merchants have found the use of these "silent salesmen" to be a very effective, up-to-date and economical method of advertising. Heretofore the posts have been erected by the Edison company, the customer buying the post and paying the construction cost at a total expense ranging from $60 to $125 a post, according to street conditions.

The posts which are being exploited are equipped with five 100-watt tungsten lamps which will be lighted every night in the year by the company's patrolmen. All lamps burn from dusk to midnight and one from then until dawn. This service is offered at a flat rate of $6.50 a month. With the folders outlining the campaign the company is distributing return postal cards which interested persons can sign to get further information. Orders for the posts will be filled in sequence of receipt, and none will be erected at the special sale price after 300 orders have been accepted.

Repairing Heating Devices to Promote Their Continuous Use

In order to insure the continuous use of electric heating appliances, the Schenectady Illuminating Company, Schenectady, N. Y., repairs all such devices free of charge where no material is needed, and charges only for the actual cost of material where any new material is required in repairing. During the past year about $900 worth of repair material was used for repairing electric-heating appliances. In the case of the electric iron the total cost to the company, including car fare, material and labor, was 13.5 cents per iron repaired. As this amount is approximately equal to the gross return from one iron per week, the policy of the company in making no labor charge for repairs is one which is founded on good business principles.

Owing to the large electrical manufacturing interests in that city, there is no direct need for canvassing for the sale of electric heating and cooking devices. However, a visit is made to every house in the company's territory once a year, to canvass for the use of electric appliances, to see if the customers are satisfied with the service rendered, to answer any questions in regard to the use of electrical energy that may be asked, to learn ways in which the company can be of service, and to learn if any electrical appliances are in need of repairs or replacement.

During the summer months the load at 10 a. m. on Tuesday mornings is 500 kw greater than at any time of the day on other days of the week. This load is known to be directly traceable to the use of electric irons. Although this extensive use of electric irons is partly due to local conditions, much of it is also due to the fact that the company is able to insure the continuous use of such devices by the policy which has been outlined in the preceding paragraphs.

The Language of the People

A very large percentage of the population of Cleveland, Ohio, is of foreign birth or foreign descent. Consequently the Cleveland Electric Illuminating Company has exerted every effort to reach this great foreign population in its own most familiar tongues. Certain publications of the company, particularly those having to do with the electrical equipment of small dwellings and small stores, have been translated and reprinted in

A STORE-WIRING CAMPAIGN IN YIDDISH

as many as five languages other than English. Reproduced herewith is the text of a folder issued in connection with the store-lighting campaign and printed in Yiddish. It will be noted that the title is at the upper right-hand side, the reader passing from right to left. At the lower left-hand side is the name and address of the Illuminating Company.

Electric Vehicles

TRAINING DEALERS TO SELL VEHICLES

What Every Man Undertaking to Sell Electric Motor Trucks Should Know About Delivery, Operation, Maintenance and Work

No conservative manufacturer of the present day is so anxious to sell his trucks as to take risks of oversold trucks and wrong applications, poor service and dissatisfied customers, on sales made from his own office, and yet very many of them are putting themselves in the position of doing exactly that thing through lack of proper training of their dealers, according to Mr. George H. Kelly, of the Baker Motor Vehicle Company of Cleveland, who addressed a motor-truck convention not long ago in Detroit.

It is essential that the dealer be trained in the same school as the factory salesman, and the problem of this sort of schooling has been handled successfully by the manufacturers in many different ways.

The important point is not how this teaching should be accomplished, but what the absolute essentials for every man who would attempt to sell motor trucks to know are.

All will agree that a complete and definite knowledge of all the mechanical details of his own product is the first requisite, together with a sufficiently accurate knowledge of the same features of other types of that class.

On the following points of operation, however, the dealer has often had little, if any, training:

What horses can and cannot do.

What electric trucks can and cannot do.

What gasoline trucks can and cannot do.

Each of these should be taken on a basis of:

First—Economy in cost.

Second—Operation.

Third—Maintenance.

Fourth—Time, quantity and quality of work accomplished.

There are certain factors of economy, maintenance and work which, reduced to terms of horse, gas or electric operation, increased or decreased by the percentage of favorable or unfavorable conditions, will give a reasonably definite result.

To reduce a given case to a basis of this sort of course requires not only a great deal of technical information but also an understanding of how to analyze delivery and improve existing conditions.

It is necessary to know how much it will cost to operate the truck for one day, but it is much more important to know how much it is likely to cost for five years.

It is quite important not to forget that there is a certain percentage of the time that each type of vehicle will be out of commission, and it is more important to know what these percentages are. Naturally business must go on, though the truck or horse does not, and temporary replacement is expensive. It is a mistake to omit this part of the cost of hauling, particularly when figuring on the other fellow's type of vehicle.

One thing that seems very difficult for the average salesman to learn, in Mr. Kelly's estimation, is that, although one truck can frequently do the work of from two and one-half to three horse teams, it is very difficult for it to be in two places at the same time, even when the places are only half a mile apart.

While speed is the curse of the motor-truck business, it is always necessary to prove speed to persuade the horse owner that he should change his delivery. Here, naturally, the inexperienced salesman is in a quandary. There is a point up to which speed is economical and beyond which it is a great expense, but it is often difficult for the man with years of training to make this clear to a purchaser who has never owned a motor truck. The natural tendency is, therefore, to sell what the customer thinks he wants, rather than what he really needs.

There is only one way to accomplish a healthy and normal sales increase, and that is to lay the right foundation—the foundation that means sales for next year and the year after. To do this it is absolutely necessary to make good sales, and it is equally important not to make bad ones. Oversold and badly sold cars have done more to hurt the motor-truck industry than any other one thing, and it is "up to" the manufacturer to do everything in his power to minimize the possibilities of this sort of sales. The first step is the proper training of the dealer. He should have a chance to start right.

Electric "Hurry-Up" Wagon for Boston

Arrests by electric patrol wagon are the latest "wrinkle" in police service at Boston, Mass., a new worm-driven General Vehicle equipment having just been added to the retributive apparatus of Station 4. The chassis carries a body 8 ft. long, 5 ft. wide and 6 ft. high, with swing-up seats, interior electric lamps and other unusual comforts. The battery is installed under the hood, and the controller and other electrical auxiliary equipment are mounted beneath the chauffeur's seat. The brake levers are so arranged that when the brakes are applied the controller handle immediately moves over to the neutral point and cannot be again operated until the brakes are released. In a test run on Tremont Street a speed of 23.5 miles per hour was attained. A number of prominent Boston electrical men were given a "joy ride" in the new conveyance on its first arrival in the city, and it is hinted that the vehicle is already proving attractive to those for whom it is performing serious service. As a horse-drawn omnibus used in prison transfer service at Boston recently fell apart on account of decrepitude while carrying victims of inebriety to the Deer Island wharf, it is anticipated that the electrification of the police department will be further extended in the near future.

Co-operative Electric Garage

A co-operative garage was recently opened by the New York Electric Vehicle Association, under the auspices of the New York Edison Company, at Central Park West and Sixty-second Street. As this is a crystallization of all phases of electric-vehicle promotion work which central stations are doing, it can be used as a cross-section in examining the whole development. Its principal elements are these: The New York association has opened the garage in co-operation with a number of leading manufacturers of electric pleasure cars. The Rauch & Lang, Detroit, and Baker companies have showrooms in the building, making it their headquarters. The garage will start with accommodation for 150 cars, more than 100 of which have already been secured. There will be a fixed charge for privately owned cars of $45 a month, which will include battery charging, care of the car, and taking it to and from the owner's residence and the garage. The object is to provide a large, centrally located garage where electric vehicles will receive special care and attention, thus facilitating the adoption in New York City of a car that has established its claim to be exceptionally well fitted for town use.

Interior Construction

Checking Labor Estimates in Electrical Contracting

Much of the uncertainty in estimating on electrical contracting lies in computing the uncertain labor item. The material required and overhead expense can generally be computed with comparative ease, but when the performance of electricians under various and often unforeseen conditions is estimated the probability of error is comparatively great. Means of decreasing the uncertainty of this factor by comparing estimates and actual costs may hence be well sought.

A prominent electrical contracting company of New York City, doing electrical contracting on both the percentage and the straight-contract basis, makes use of the weekly time vouchers of the electricians for this purpose. The labor item on each job under way is computed weekly. Estimates of the labor required for different classes of work may hence be checked with the actual labor required. All such data, the original estimates, the copy of the proposal, material tickets, etc., for a job are placed in a large envelope containing the number of the job. Such envelopes are placed in the file cases where they can be conveniently found during the progress of the work or at any future time. A card index permits a job number to be obtained from the name of the building.

☞ NOTICE.—This Company will not be responsible for any damages to house furniture or ornaments, occasioned by carelessness of workmen. Under no circumstances handle, touch or move any article in the premises you may be at work. Call a servant to made any required changes.

☞ This Voucher must be signed by Workman personally, and countersigned by Superintendent of Construction before it will be accepted by Company.

☞ This Voucher must be mailed or sent so as to reach office THURSDAY A. M. of each week.

The Electrical Construction Co.,

Week ending *191*

Report of Time and Cash Expenses.

Job of .....

At .....

Job No. .....

Date .....

CASH DUE UNDERSIGNED FOR

..... *Day,*	@		
..... *Hours,*	"		
..... *Fares,*	"		
Sundries, ...			
.....			
Total,			

..... WORKMAN.

Countersigned, ...

SUP'T

☞ Make a slip out for each job, giving date, character of work and expenses incurred thereon for fares or otherwise.

☞ On the back of this slip, beginning at the bottom, make memorandum of time expended and expenses incurred on each class of work.

WEEKLY TIME VOUCHER

BROADENING THE CONTRACTOR

What Co-operation Between Inspector, Contractor and Journeyman Has Done in Louisville

There was a time when the average electrical contractor thought that the inspector was a necessary evil, and when an order to tear out a wiring installation and replace it according to the ideas of the inspection authorities was regarded merely as evidence of a diabolical desire on the part of the latter to cause the contractor to lose money.

The modern idea, of course, is entirely different. The contractor knows that inspections are necessary; he realizes that with the large number of people in the business, including the tyros, the careless and the unscrupulous, the community must have some safeguards against defective work. The proper system, therefore, is to co-operate with the inspectors, working with them in the direction of the establishment of proper standards and the elimination as far as possible of defective work.

One of the most striking proofs of the value of co-operation in this direction is furnished by the experience of the Electrical Clearing House Association of Louisville, Ky., which is made up of the contractors and their journeymen and the inspection officials, including the city and fire-insurance-rating authorities. This organization has been in existence for a comparatively short time, but the contractors as well as the officials unite in declaring that it has filled a long-felt want and that it is the most beneficial idea that has ever been put into practical use.

Aims of the Clearing House Association

Mr. C. C. Childers, of Childers & Waters, who is president of the Electrical Clearing House, is enthusiastic over the possibilities of the idea.

"Formerly," he said, "there was no organization where the little fellows were represented. We have had plenty of associations in the electrical business, but the trouble is that only about 5 per cent of us belong to them, and the other 95 per cent, who are handling a great part of the work, are outside. The clearing house is inclusive and takes in everybody. The big contractor and the little one meet on a common footing, with nobody at an advantage, and the benefits are bound to come. Some of the contractors who are just starting in and haven't got experience or knowledge are learning the code and are being shown how they ought to do the work. While this is making the electrical installations better from the standpoint of the fire underwriter, it is also making these contractors better business men and more successful members of the trade. When they do poor work they lose money, because defective wiring that has to come out and be replaced means additional labor and wipes out the profits. That's where the supply men lose, too, because when the little fellow falls down he can't pay for his materials. So you see the clearing house benefits everybody in the business, besides bringing about a great improvement in the character of the work that is being done."

Louisville is one of the first cities which have adopted the clearing-house plan, but that it will not be the last is evidenced by the interest which has been taken in it by members of the trade in other cities. The idea is to be adapted to conditions elsewhere, and inasmuch

as it is of general application, there is no reason why it should not be universally used.

When the clearing house was formed it was chiefly to study the National Electrical Code and to clear up a few points about which there had been some misunderstanding. (This, by the way, is one of the most important features of the work—to get rid of the numerous interpretations put on the rules, and to decide exactly what they mean, and then adhere to that interpretation.) The first meetings were so well attended, however, and the benefits proved so great that it has been decided to make the organization permanent.

Everybody connected with the electrical business in any way is eligible to membership, and the annual dues of $1 will probably not scare anybody away, not even the smallest and most modest contractor. The dues will merely pay for postage to enable notices to be sent out.

Fixture Men Eligible

One of the branches which have benefited by the work of the clearing house in Louisville is the fixture trade. The members of this business have had no organization, but the clearing house has made room for them. They have arranged a basis of co-operation with the contractors which has resulted in the adoption of methods of installing the wiring which lessen the labor of hanging the fixtures very materially without increasing the cost to the contractor. Fred G. Burford, of the Burford & Brecher Company, a leading fixture concern of Louisville, is vice-president of the organization.

The Electrical Clearing House is referred to occasionally in Louisville as "the triple alliance," because it brings together the city inspectors, the rating bureau inspectors and the contractors themselves. Everybody is now working together, and the results have proved that when the general interests are considered everybody benefits.

The meetings are held in the assembly room of the Kentucky Actuarial Bureau on the twelfth floor of the Starks Building. The attendance is from forty to fifty, and on occasions the room proves too small to hold all those who wish to take part in the meeting. There is usually a talk by a speaker of note on a topic of general interest, while discussions of moot questions receive attention. Blackboard demonstrations by the inspectors are a feature, and anybody who has a trouble or a question or a doubt has ample opportunity to get it settled before leaving the room.

The attendance is not limited to the contractors; their journeymen also attend the meetings, this being one of the most beneficial features. The man on the job is the chap who must be educated, and it is felt that giving those who, in the final analysis, are responsible for the results an opportunity to find out the hows and whys is an excellent policy. It has certainly worked well thus far in Louisville.

Misunderstandings Cleared Up

If a contractor believes that he has been made the victim of an unjust ruling, he states his case and the matter is explained by the inspectors. If a new rule is promulgated, and the contractors feel that not sufficient time has been allowed to enable them to adjust themselves to it, this is discussed and an amicable conclusion arrived at. In every case, however, every interest is considered, and the motto of the organization, to do the thing right, is closely adhered to.

Mr. E. C. Knoop, of the electrical inspection department of the Kentucky Actuarial Bureau, is secretary of the organization, and is most enthusiastic over the results from the standpoint of the fire underwriters.

"There has been a material improvement in conditions," he said. "Better work is being done and fewer defects are being noted. The contractors are improving the character of their installations, and they, the owners and the fire-insurance companies are benefiting. Owing to the fact that many people enter the contracting business with insufficient experience, it is certainly desirable that there be some organization or medium where they can acquire the necessary information, and the clearing house gives them ample opportunity to learn the code and bring themselves up to the required efficiency. From an insurance standpoint it would be almost impossible to conceive of a better system for improving conditions, and we can safely say that the clearing house has given to the electrical business a much better status than it has ever had before in Louisville."

As an instance of the work which is being done along this line, the loop system has been adopted and joints have been done away with. The latter method of wiring was formerly used to a great extent, especially in the cheaper installations. Its elimination is regarded as a big improvement from a fire-prevention standpoint. The clearing house is also contemplating adopting a rule requiring all entrances to buildings in the fire district to be made in conduits. The conduit system is being used voluntarily by many owners, of course, but putting it on a compulsory basis will undoubtedly lead to this protection being provided in many cases where it would not be used under present conditions.

Convenient Estimate and Proposal Sheets

The work of the National Electrical Contractors' Association in devising uniform proposal and estimate sheets has resulted in the production of sheets that permit estimates and proposals to be made not only in uniform style but also with great convenience. One of the advantages of this association's universal-estimate and uniform-proposal sheets is that they tend to promote intelligent and accurate estimates and proposals by providing blanks with appropriate headings which tend to remind one of the various items entering into the making of an estimate or proposal. In addition to this advantage, the use of uniform sheets for all copies of estimates and proposals permits the keeping of all such records in files where they may be conveniently found at any time.

Both of these forms are shown in the accompanying illustrations. The form for the uniform-proposal sheet, it will be noticed, permits the making of a contract which is definite with comparative ease. On the rear of the sheet the following explanation of the terms and abbreviations used is given:

"Lts.—The number shown in this column designates the number of 40-watt lamps, or their equivalent, allowed for the outlets shown on the same line. Ceil—An opening in the ceiling wired ready for the hanging of a fixture. Bkts.—An opening in the side wall wired ready for the hanging of a fixture. F.R.—An opening wired into a steel box ready for the attaching of receptacles whose plates, when added, shall be flush with the plaster. Receptacles to be used for the connecting of portable lamps and other electrical devices. S.P.F.—An opening wired into a steel box ready for the attaching of a switch whose plate, when added, shall be flush with the plaster. Each of these switches will control lamps attached to the opening appearing on the same line. 3 W.F.—Openings wired into steel boxes for the attaching of switches whose plates, when added, shall be flush with the plaster. Each of these switches will control lamps attached to the opening appearing on the same line. S.P.S.—An opening wired ready for the attaching of a switch whose base will be outside of the

National Electrical Contractors' Association Universal Estimate Sheet.

NO. LIGHTS _____
NO. SWITCHES _____
NO. CIRCUITS _____
NO. BASE PLUGS _____
NO. TELEPHONES _____
NO. MOTORS _____
NO. FIXTURES _____
H. P. MOTORS _____
K. W. GENERATOR _____
SWITCHBOARD _____

Bid Goes to _____
Address _____
Architect or Engineer _____
Address Architect or Engineer _____
Name of Job or Building _____ ESTIMATE NO. _____
Location of Job or Building _____ SHEET NO. _____
See Mr. _____ Telephone No _____ DATE _____ 19____
Bid Must Be In by _____ M. _____ Salesman _____ JOB NO. _____

Material Estimated by _____ Labor Estimated by _____ Priced by _____ Approved by _____

REMINDERS	QUANTITY	DESCRIPTION	PRICE EACH	TOTAL COST	LABOR UNIT	TOTAL LABOR
Conduit, Rigid						
Conduit Elbows						
Conduit Bushings						
Conduit Straps						
Conduit Hangers						
Lock Nuts						
Conduit Flexible						
Conduit Fittings						
Conduit Non-Metgll						
Ceiling Boxes						
Bracket Boxes						
Switch Boxes						
Floor Boxes						
Box Covers						
Fixture Hangers						
Cutout Cabinets						
Panelboards						
Metering Panels						
Meter Loops						
Cutout Boxes						
Asbestos						
Cut Out Blocks						
Fuse Plugs						
Enclosed Fuses						
Flush Switches						
D. P. Flush Switches						
3 Way Flush Switch						
4 Way Flush Switch						
Snap Switches						
D. P. Snap Switches						
3 Way Snap Switch						
4 Way Snap Switch						
Knife Switches						
Door Switches						
Pendant Switches						
Rubber Covered Wire						
Lead Covered Wire						
Fixture Wire						
Special Wire						
Lamp Cord						
Reinforced Cord						
Packing House Cord						
Show Window Cord						
Molding Wood						
Molding Metal						
Molding Fitting						
Fixtures						
Clusters						
Key Sockets						
Keyless Sockets						
Wall Sockets						
Rosettes						
Socket Bushings						
Cord Adjusters						
Shades						
Shadeholders						
Adapters						
Attachment Plugs						
Lamps, Incandescent						
Lamp Guards						
Arc Lamp						
Cleats						
Knobs						
Tubes						
Screws						
Nails						
Toggle Bolts						
Annunciators						
Annunciator Wire						
Annunciator Cable						
Elevator Cable						
Bells						
Buzzers						
Push Buttons						
Silk Cord						
Door Openers						
Burglar Alarms						
Batteries						
Bell Ringers						
Telephones						
Telephone Cable						
Speaking Tube						
Whistles						
Letter Boxes						
Tape						
Solder		TOTAL				
Compound						
Acid		BID SENT TO FOLLOWING:		MATERIAL		
Oil						
Car Fare				LABOR		
Cartage						
Bond						
Drafting				OVERHEAD EXPENSES Per cent		
Inspection						
Incidentals				PROFIT Per cent		
				BID		

FIG. 1—UNIVERSAL ESTIMATE SHEET OF NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION

plaster. This switch will control the lamps attached to the opening appearing on the same line. 3 W.S.—Openings wired ready for the attaching of switches whose base will be outside of the plaster. Each of these switches will control the lamps attached to the opening appearing on the same line.

Four-Way Switch—When a four-way switch is shown in special column it is understood that the lamps attached to the opening shown on the same line are to be controlled from as many additional points as there are four-way switches shown. Special—Bell work and other special work not otherwise listed will be shown in this column. 'Roughed in' is understood to mean that the wiring is to be completed, ready for the hanging of fixtures, without, however, fused main-line switch, branch blocks and steel entrance box, and without receptacles, switches and plates. 'Finished' is understood to mean that the wiring is to be completed, ready for the hanging of fixtures, with fused main-line switch, branch blocks and steel entrance box, meter loops, and with all receptacles, switches and plates installed."

The universal - estimate sheet, in addition to having appropriate blanks for the number of lamps, switches, circuits, base plugs, etc., required, contains a large number of "reminders," among which are even nails and screws. The labor involved in installing the apparatus and wiring is intended to be estimated by means of those labor units which the contractor has found through experience to be proper for the various types of work involved. Provision is also made for the addition of the two factors upon which many contractors do not lay due stress—overhead expenses and profit.

These sheets are on sale by the National Electrical Contractors' Association, Mr. George H. Duffield, secretary, 41 Martin Building, Utica, N. Y.

UNIFORM PROPOSAL

Estimate No.---------- ----------19----

To ----------
(Owner)

Address----------

.....hereby propose to furnish all the labor and material necessary to do the Electrical Work in and about the premises located at..... for the sum of..... Dollars.

Payments therefor to be made by the Owner to the Contractor every thirty days after the beginning of the work, said payments to be at least.....per cent of the value of all the labor and material installed, final payment to be made within.....days after completion of contract.

The work done and the material furnished under this proposal to comply with all the City Ordinances governing this class of work and in accordance with the latest rules and requirements of the National Board of Fire Underwriters for the installation of Electric Wiring and Apparatus, and said work shall be of the amount and kind designated below.

The within proposal shall become a contract between the parties hereto when duplicate is signed and returned by the Owner to the Contractor within.....days from date above shown, otherwise the within proposal shall be null and void.

All changes in this proposal to be made in writing and signed by both parties hereto, which said writing shall set out and contain in full the character, extent, cost and conditions of said changes.

Building	Conditions of Building	Class of Work	
Frame	Under Construction	Concealed	Rigid Conduit
Brick	Being Remodeled	Open	Flexible Conduit
Concrete	Completed	Knob and Tube	Armored Conductors
		Metal Moulding	

Extent of Work	Meter Location	Inspection
Roughed In		
Finished	.....	.....

(For explanation of terms and abbreviation see reverse side of this sheet.)

OUTLETS

ROOMS	LTS.	CEIL.	BKTS.	F. R.	S.P.F.	3W F.	S.P.S.	3W.S.	SPECIAL

The above proposal is hereby accepted,

this.....day of....., 19.... Respectfully submitted,

..... Owner. ..... Contractor.

FIG. 2—UNIFORM PROPOSAL SHEET ADOPTED BY NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION

Look Before You Bid

Scrutinize carefully plans on which you are bidding, was the advice of a speaker before the recent convention of Minnesota electrical contractors. Take in all the details and understand the plans thoroughly before returning them. Such care at this time will protect the bidder against expensive omissions which he will later be called upon to supply. Dates of bids should also be examined, for the prices of materials often change without warning. When estimates have been prepared on a certain set of specifications, the figures obtained, even if unsuccessful, represent useful information for the contractor himself, and such estimates should therefore be carefully preserved for reference in making other bids on jobs of a similar character. One contractor keeps all such estimates at least five years. Moreover, it is not a bad idea before bidding first to ascertain whether or not the credit of the new customer is satisfactory.

Think Before You Kick

Although the motto over the cashier's counter in the office of the Dayton (Ohio) Power & Light Company bears only the statement "It isn't the light you use but the light you waste that costs money," the sign carries an additional message to the public. To the person approaching the cashier's counter with the belief that his bill is too high it gives a new idea. It suggests the notion that perhaps some one of the family has been extravagantly wasting electricity. The sign in reality is an adroitly worded admonition to the customer to "think before he kicks," for it is well known that a little conscientious thinking would save a lot of kicking.

Lighting Practice

Inducements for Operating Night Lamps

By calling the public's attention to the protection from burglary afforded by having the home illuminated all night, central-station companies should be able to fill in the valley of the load curve between midnight and morning. Then, too, it may be pointed out to mothers that children may be induced to sleep alone if their rooms are dimly illuminated all night. Where gas companies are to be competed with, objections to gas lighting may be used indirectly by showing that they do not exist with electric lamps. For instance, it may be stated that with electric light there is no danger of asphyxiation or impairment of health, that paintings cannot be discolored, silver cannot be tarnished, and house-plant growth will not be stunted.

Make 2 A.M. as safe as 9 P.M.
Real security means keeping the would-be intruder outside.
Will the burglar cross a LIGHTED porch? Will he attack a house with a light upstairs? Not he!
Yet this protection and the convenience of an all-night light in bathroom or hall will cost you only a cent or two a night if you use EDISON MAZDA Lamps. If one EDISON MAZDA is such an economy, why not gain all they can save for you by using EDISON MAZDA Lamps in every socket in the house? They're genuine economy, for they give 3 times as many hours of light for the same money!
Be sure the MAZDA lamps you buy bear the name EDISON
Ed. 61
Which of these Homes will the Burglar Shun?
Not the pitch-dark house—easy to approach unseen, easy to reenter without detection.
It's the home with the all-night lights that's safe.
Imagine a burglar dating that porch-light or attacking a house with a light upstairs!
For only a cent or two a night, you can burglar-proof your home in this way, if you use EDISON MAZDA Lamps—and have besides the convenience of an all-night light in your bath-room or hall-way.
EDISON MAZDAS give you 3 times as many hours of light for the same money as old-style carbon lamps, some of the smaller sizes giving light all night for a cent.
To gain all that EDISON MAZDAS can give you in burglar protection, convenience and economy—you should have them in every socket in your house.
Be sure the MAZDA lamps you buy bear the name EDISON
Ed. 60
(Insert Dealer's Name Here)

SUGGESTIONS FOR INTERESTING PUBLIC IN ALL-NIGHT LIGHTING

If cost of operation is raised as an objection, low-wattage lamps can be advocated for all-night use. During months when darkness exists longer than daylight a 10-watt lamp can be operated from dusk until 7 a. m. for not more than 43 cents a month at a rate of 10 cents per kw-hr. During the summer months the cost of energy will run lower, making the yearly cost about $4.50 per unit. In a year not more than three renewals should be required, making the total cost about $5.50. Presented on a daily basis of 1.5 cents, the convenience and protection of electric light ought not to be refused by anyone. Another use for low-rated lamps is in the sick-room, when continuous but not too intense illumination is usually desired. Calling attention to various portable lamps which are being continually placed on the market and displaying them so that their advantages are emphasized should also assist in increasing the connected load of a station.

Good Window Lighting Demonstrated Free of Charge

If a merchant has some electric lamps in his window, he generally feels that his window displays are well illuminated. About the only way to convince him that his installation may be inadequate is to show him the difference between good lighting and his own installation. One successful method of showing up antique and inefficient display lighting is being used by Mr. Edward Quillan, new-business manager of the Alliance (Ohio) Gas & Power Company. His plan is simple in operation, but beyond doubt carries conviction.

Selecting the merchant whose display lighting is most in need of improvement, the new-business agent of the Alliance company talks to the man about it and gets permission to install a temporary window-lighting outfit at the expense of the central-station company. The temporary installation consists of one or more 4-ft. strips of wooden molding each equipped with four sockets carrying 60-watt lamps shaded by enameled reflectors. One or two of these strips can be placed quickly in a window and connected to the existing wiring with very little effort or expense.

To do away with the difficulty of getting the merchant to come down town at night and observe the contrast between the new and old systems, a photograph is taken of his store front, showing, if possible, one of his windows with both old and new equipment. If the merchant has only one window, one-half of the display space is lighted by the temporary installation, and even in such windows the contrast is marked.

Two windows in a clothing store are shown herewith. In the window at the left eight 60-watt lamps supply all of the illumination, while the display at the right is lighted by four 150-watt lamps, and there is a 150-watt unit in the table lamp shown. Rehabilitation of these windows resulted in a decrease in connected load from 700 watts to 480 watts, but the merchant became a better satisfied customer and signed a long-hour contract which brought his total energy consumption to approximately what it had been with the old lighting system.

Not only the store shown in the illustration but also other local stores where similar trials have been made now have all their display windows lighted with modern equipment.

TWO WINDOWS IN A CLOTHING STORE WITH PROPER AND WITH IMPROPER LIGHTING

NEW APPARATUS AND APPLIANCES

Electric Lantern

The electric lantern shown herewith is shaped like an ordinary kerosene lantern and is equipped with a standard No. 1 chimney. The height of the device is 9 in., width 6 in., weight without battery 1 1/3 lb. and with

BATTERY-OPERATED LANTERN

battery 2¼ lb. The metal parts are of brass and steel and are heavily nickel-plated. Use is made of a 3.8-volt tungsten lamp, which is operated by a three-cell battery. The space occupied by the battery is 1.25 in. by 3 in. by 4 in., and the battery will give fourteen to sixteen hours' continuous service or twenty-eight to thirty-two hours' intermittent service. The lantern is equipped with a searchlamp reflector as shown. The contact lever is conveniently placed at the side of the base. The cage and reflector are removable so that the lamp can be used for other purposes besides that for which it is primarily designed. The bottom of the lantern is made of one-piece drawn metal and is waterproof. It is fastened to the top by three bayonet-lock connectors. The chimney can be removed from the top. The connectors are reinforced with rivets or special metal fastenings to insure strength. The "Yale" electric lantern, as it is called, is being made by the Baker-Smith Company, Rialto Building, San Francisco, Cal.

Electric Automobile Horns and Push-Button

The accompanying illustrations show one of the types of electric automobile horns recently placed on the market by the Benjamin Electric Manufacturing Company, Chicago, Ill., and a push-button designed to control the same. The horns are designed to operate on battery current and have a laminated magnet, massive contacts, Swedish spring-steel diaphragm and springs,

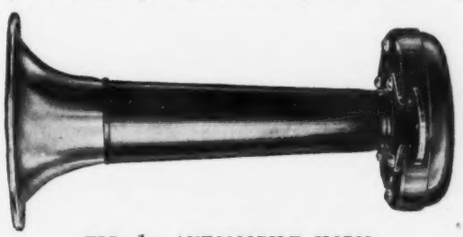


FIG. 1—AUTOMOBILE HORN

and a special screw lock. Similar horns are manufactured for motorcycles, launches, etc. A horn known as the "Fordorn" is also manufactured for use on Ford automobiles, the ignition magneto being employed for furnishing energy. The push-button designed for operating the horn illustrated is of unusual construction. The whole top of the button, which is 1.25 in. in diameter, acts as a moving contact element and is so designed that the touching of any portion of it causes the circuit to be closed. The contactor surface is about 1.50 in. in circumference. If any corroding of the con-

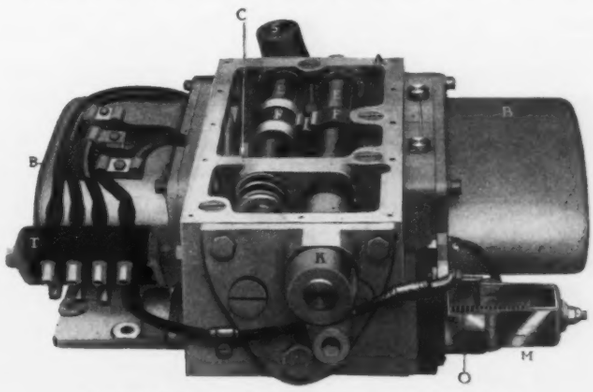
FIG. 2—PUSH-BUTTON FOR STEERING-WHEEL MOUNTING

tact elements takes place, the contact surfaces can be easily cleaned by merely depressing the button and giving it several light turns. These buttons are made in the steering-wheel, fore-door and flush-mounting types.

Electric Gear Shifter

The Vulcan electric gear shifter for automobiles, which is being made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has recently been completely re-designed and a number of improvements have been added. By means of this apparatus the gears on the shaft are shifted by electromagnetic force, and the control is centralized at the steering wheel. A solenoid is provided for each change, and each solenoid is controlled by a push-button on the steering wheel. The gears are moved back to the neutral position by means of a clutch pedal.

Referring to the accompanying illustration of the apparatus, the gear-shifting mechanism consists of a case "A," which is attached to the transmission housing. The solenoids are inclosed in this case. To the armatures of the solenoids are attached shifting forks which move the sliding gears in the transmission. The operating mechanism by means of which the gears are mechanically drawn to the neutral position through connection with the clutch pedal is also inclosed in this case. The case is divided into two compartments, the smaller of which contains the operating mechanism for



ELECTRIC GEAR SHIFTER FOR AUTOMOBILES

the neutralizing of the gears and the operation of the master switch.

Assuming that all gears are in a neutral position—that is, the sliding gears are not in mesh—and that it is desired to start, the first speed button on the steering wheel is depressed. The operating lever *K* and the shaft on which it is mounted are rotated and the master

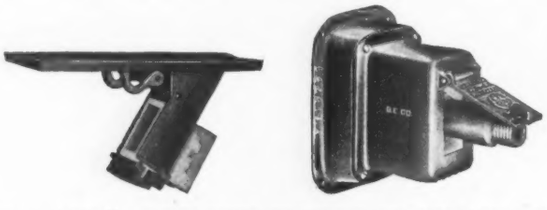
switch *M* is pulled into engagement through its connection with the operating mechanism which engages the switch stem. Owing to the pull of the magnet against the neutralizing cams *F*, a pawl connected to the neutralizing mechanism is raised and the master switch snaps out instantly, owing to the action of the master spring *O*, thus breaking the electric circuit.

Being in first speed and desiring to proceed to another, the other speed button upon the wheel may be depressed. The clutch is then fully depressed as before, and the operating lever *K* and its shaft, which carries the rocker arm and its attached mechanism, are rotated. Since the first gear, or whichever gear has been previously selected, is in mesh, a latch is in engagement with a pawl belonging to the neutralizing mechanism, and as the operating lever and rocker arm are rotated, the latch presses against the pawl, causing both the neutralizing cams to rotate toward the center, owing to the fact that they are enmeshed through teeth. On the central side of the shifter forks there is a boss, and as the neutralizing cams rotate toward the center, they press against the boss on whichever side the gear is in engagement. This action causes the shifter fork and the gear with which it is engaged to be pulled back to the neutral position before the next shift can be made. As the gear reaches the neutral position, the end of the latch strikes a knock-out pin, and the latch is released from engagement with the pawl. Since the operating lever is moved ahead by the foot of the driver on the clutch pedal, the switch operating another pawl pulls against the switch stem, closing the circuit at the master switch. The electric circuit is completed, and the proper gear jumps into engagement.

Should it be desired to stop, the neutral button on the steering wheel is pressed down, and any other button which may have been depressed is automatically raised. Any selection may be made at any time by pressing any push-button on the wheel. This selection, however, does not necessarily influence the changing of the gears in the transmission, since nothing happens until the master switch is closed by the pressing all the way down of the clutch pedal. In case of battery trouble or damaged circuit, an emergency shifting lever is provided so that the gears can be shifted by hand.

Stage Pockets

Fig. 1 shows a rigid type of stage pocket recently developed by the Sprague Electric Works of the General Electric Company. It consists of a removable porcelain receptacle and a detachable outer box or casing which, in the standard form, is open at the bottom. Another type of stage pocket wherein electric contact can only



FIGS. 1 AND 2—RIGID TYPE OF FLOOR POCKET AND STAGE WALL POCKET

be made after the plug is inserted and the door closed has also been recently developed. Both types can be furnished with either one or two receptacles.

Fig. 2 shows a stage wall pocket which is also said to be suitable for use in hotels, residences, factories, etc. It is of waterproof and dustproof construction and consists of a porcelain receptacle containing the contacts, an iron box in which the receptacle is mounted and a base or junction box tapped for 1-in. conduit in the type illustrated and for 1.25-in. conduit in the case of a double wall pocket.

Metal Electric Incubator and Hover

The incubator and hover shown in Figs. 1 and 2 are heated by carbon lamps. The outside casing of the incubator is of enameled sheet steel, and the inside or egg chamber of galvanized iron. The air space between the two is insulated with fireproof material. Ventilation is controlled from the outside by means of a metal slide

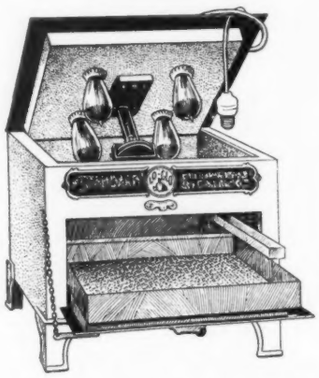


FIG. 1—INCUBATOR WITH DOOR RAISED, SHOWING CARBON LAMPS USED TO HEAT THE DEVICE

in the bottom of the incubator. A moisture or humidifying tank is on a flange attached to the side of the egg chamber and slides in or out as desired. The wires are placed between the outer and inner metal parts of the removable top of the machine. The egg trays are of galvanized wire and are graduated in size so that each single tray will hold about 100 eggs. Wherever the dimensions permit, the egg trays are made in sectional squares, so that the position of the eggs relative to the center, sides and corners can be changed without touching the eggs themselves. A door is provided with double-glass windows, so that all parts of the interior are always visible. A card slide is attached to the side of the machine for keeping records of the hatch. The

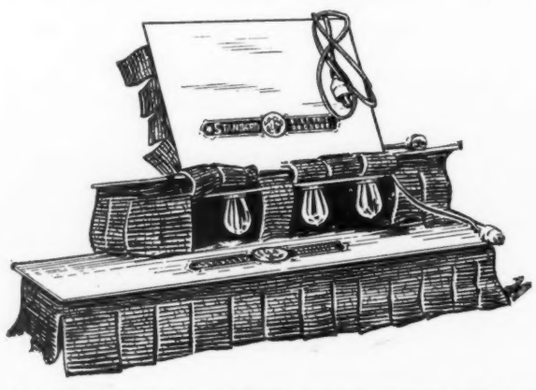


FIG. 2—ELECTRICALLY HEATED CHICK HOVER WITH FELT CURTAIN

temperature is automatically regulated by means of a thermostat. The incubator is made in eight different sizes, with capacities of 50 eggs, 65 eggs, 85 eggs, 120 eggs, 160 eggs, 210 eggs, 310 eggs and 420 eggs respectively. The respective weights of these machines are, uncrated, 33 lb., 42 lb., 52 lb., 60 lb., 86 lb., 99 lb., 129 lb. and 165 lb., and the floor space occupied by

each is 13 in. by 20 in., 18 in. by 18 in., 21 in. by 21 in., 24 in. by 24 in., 27 in. by 27 in., 30 in. by 30 in., 36 in. by 36 in. and 42 in. by 42 in.

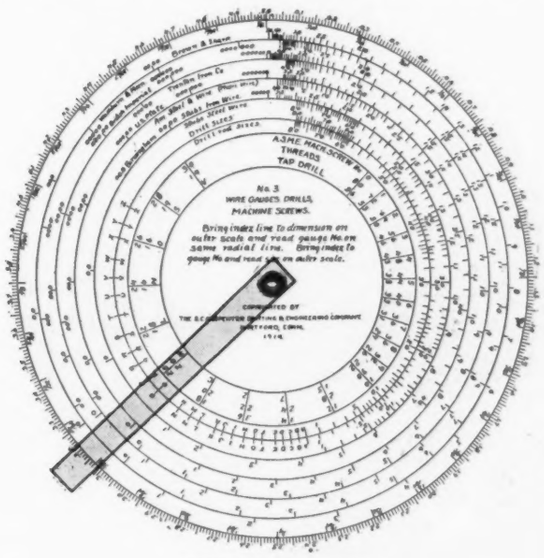
The hover shown in Fig. 2 is similar in construction to the incubator. A felt curtain surrounds the frame and provides ample shelter, it is declared, for the chicks. Cleaning is accomplished by lifting up the hover from time to time and sweeping out under it. The carbon lamps used with the electric hover are wired in series, each lamp giving 2 cp. The hover is made in three sizes, provision being made for 50 chicks, 100 chicks and 150 chicks respectively. The respective weights of the hovers, uncrated, are 9 lb., 12 lb. and 18 lb., and the floor space covered by each is 16 in. by 22 in., 16 in. by 32 in. and 16 in. by 44 in.

The incubator and hover described above are being made by the Lo-Glo Electric Incubator Company, 76 Greenwich Street, New York.

Wire-Gage and Pay-Roll Charts

The wire-gage chart illustrated herewith is of strong pressboard and is 6 in. square. Circular scales are printed on it as shown, the outer scale giving thousandths of an inch up to 0.5 in. By means of an index line on a transparent radial arm various values can be ascertained on the inner scales, which contain eight of the principal wire and plate gage numbers, drill sizes, drill-rod sizes and A. S. M. E. machine-screw numbers, and thread and tap-drill numbers. Comparisons can also be quickly made from one gage to another. The chart has been prepared by the S. C. Carpenter Drafting & Engineering Company, 26 Baltimore Street, Hartford, Conn.

A pay-roll chart is also being made by the above company and consists of a circular disk revolving on a 6-in. square base. A scale on the edge of the disk coincides with a scale on the base and gives readings for the number of hours and minutes from any time "in" to any time "out" from 7 a. m. to overtime at 10 p. m. On



WIRE-GAGE CHART

the body of the disk the different rates increasing by increments of 2 cents and 2.5 cents from 10 cents to $1.54 per hour for one, five, ten, fifteen, thirty and forty-five minutes and for one to nine hours can be ascertained. The pay for a larger number of hours can be quickly found by addition. A double parallel scale of minutes and decimals of an hour is also given.

Removable-Plate Yard Charging Receptacle

The accompanying illustration shows a single-outlet railroad-yard charging receptacle with an auxiliary receptacle for supplying energy to vacuum cleaners, hand lamps, etc., the complete device being made from the manufacturer's standard yard charging-receptacle parts. These parts consist of a frame, a housing for

YARD CHARGING RECEPTACLE FOR UNDERGROUND CONDUIT SYSTEM

the outlet, numerous top, bottom and side plates, hubs, etc., which permit a number of different combinations to be made suitable for use with underground and surface conduit system under various conditions. These receptacles, it is claimed, are absolutely weatherproof and either spring or clamped removable, water-tight doors can be furnished for the outlet. These receptacles and receptacle parts are manufactured by the Crouse-Hinds Company, Syracuse, N. Y.

Battery Lantern

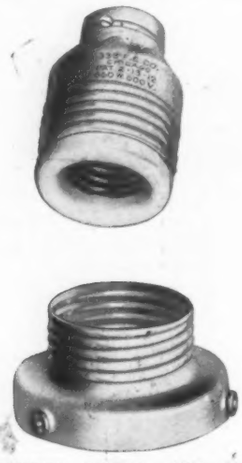
A rugged battery lantern known as the Step-O-Lite is shown in the accompanying illustration. At a point 1.5 in. from the top of the cell a hole about 0.5 in. in diameter is cut in the paper carton of the battery to allow the center terminal of the lamp to make contact with the zinc shell. The other lamp terminal is connected through a band encircling the cell, the carrying

ELECTRIC HAND LANTERN

handle and a spring switch to the center-battery terminal. An 8-cp lamp capable of burning continuously for from ten to twelve hours on a fresh cell is employed. A special reflector is also provided for the lamp, all metal parts being highly polished and lacquered to prevent tarnishing. These lanterns are manufactured by the Bass-Moody Company, Peoria, Ill.

Socket and Shade Holder

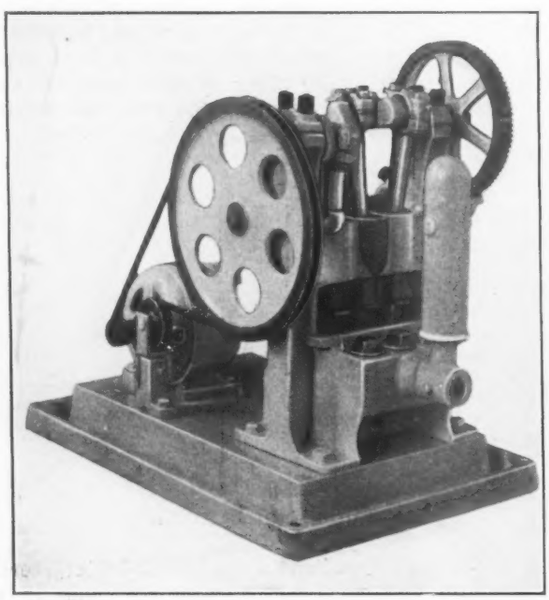
The socket shown herewith is of heavy porcelain and is equipped with a copper shell and aluminum top. It is designed particularly for outdoor work, factory and mill wiring, etc. The shade holder used with this device is of aluminum. The shell has been made of copper, the manufacturers declare, because copper is more yielding than other metals and a lamp is not so liable to shake lose from the copper shell in case the socket is employed in a place where there is considerable vibration. The socket is designated as No. 333 and the shade holder as No. 334. Both devices are being made by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, Ill.



SOCKET WITH COPPER SHELL AND ALUMINUM SHADE HOLDER

A Motor-Driven House Pump

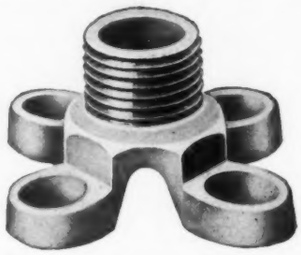
The accompanying illustration shows a pump designed for use on a farm or country estate and in some manufacturing establishments. The outfit is said to require no attention or care except occasional lubrication, and it may be installed in any convenient place, being easily and safely controlled from a distant point by means of a simple switch. The pump is driven by a ⅛-hp Westinghouse electric motor and is capable of filling a 300-gal. tank placed 120 ft. above it in less than three hours. The pump is of the triplex type with cylinders 1.25 in. by 2 in., the height of the pump being 21 in. and its base 16 in. by 23 in. The pump is manufactured by the Goulds Manufacturing Company, Seneca Falls, N. Y., and the motor by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.



MOTOR-DRIVEN HOUSE PUMP

Hollow Fixture Stem

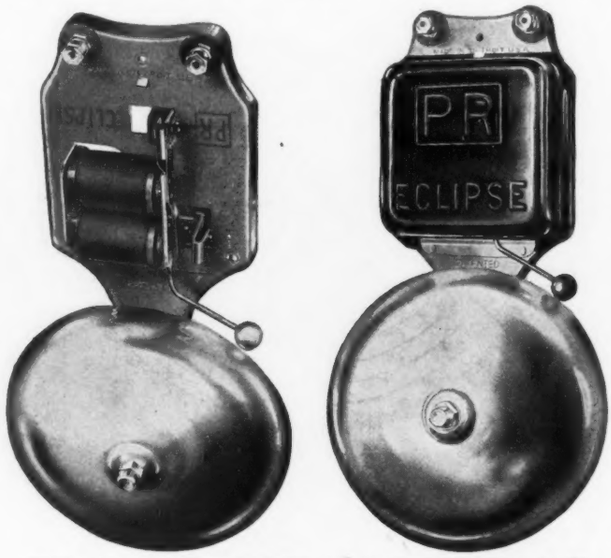
The fixture stem shown herewith is hollow and is of the hickey type. The device is of malleable iron and after being threaded it is sherardized. It is made in two sizes, one 0.5 in. in diameter and the other ⅜ in. in diameter, by the Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa.



MALLEABLE-IRON HOLLOW-FIXTURE STEM

Electric Bells

Electric bells ranging in size from 5 in. to 12 in. in diameter and mounted on steel bases are being made by the P R Manufacturing Company, 621 Bellevue Avenue, Detroit, Mich. The base is reinforced and supports for fastening the screws are flush with the edge of the base. The striker arm is rolled to a spring temper. The armature is of soft steel and the contact springs of phosphor bronze. A screw is provided for adjusting the armature tension. Use is made of a nickel-plated steel gong. The cover is of pressed steel and is finished in black enamel. Fig. 1 shows the eclipse bell as it is called with cover removed, and Fig. 2 with cover in place.



FIGS. 1 AND 2—ELECTRIC BELL WITH STEEL BASE

Small-Sized Dental Motor for Direct Drive

An interesting development in small motors has recently been completed in the form of a dental motor which can be held in the hand, as shown in Fig. 1. According to the manufacturer of the device, the Shelton Electric Company, 30 East Forty-second Street, New York, the machine is the smallest motor designed for commercial purposes ever built. The motor is 1.25 in. in diameter and 1.75 in. long, and weighs only 5.25 ounces. The motor operates at a speed of 15,000 r.p.m., and it takes a standard dental chuck, which is driven with a one-fourth reduction in speed. This reduction in speed, it is declared, is accomplished without gears or friction devices.

FIG. 1—METHOD OF OPERATING DENTAL MOTOR

The motor operates on either direct current or alternating current. The armature is hand-wound with No. 40 wire. Use is made of special ball bearings, 1/16 in. in diameter, and the air gap between the armature and field is 0.0025 in. The switch is of the plunger type and is operated by a lever which can be pushed back if necessary by the back of the hand. The lever can be placed in three positions, that nearest to the motor being for reverse operation, the center position for stop, and the position farthest away from the motor for starting. The shaft of the motor is hollow, and bakelite is utilized as insulation. The motor is inclosed in an air-tight steel case.

For varying the speed of the motor a rheostat is provided which can be placed on the floor and can be operated by a foot lever. In case it is necessary for the dentist to call on his patients, a rheostat similar to that shown at the end of the cord in Fig. 2 is employed. This rheostat is operated by hand.

FIG. 2—DENTAL MOTOR ATTACHED TO CORD WITH RHEOSTAT

Besides being adaptable for dental work, the motor can also be utilized for engraving, manicuring, chiropody and as a light bone drill for physicians. There is no sparking of the commutators, it is declared, and the device takes only 12 watts. The following advantages were enumerated to a representative of the ELECTRICAL WORLD by Mr. Gentry Shelton, president of the above company: The motor is light in the hand as there is practically no back drag or buckling of cable; efficient operation is obtained on account of direct drive, and it is not necessary to place the motor on brackets which are liable to be in the way. The motor is also well adapted for use by students in dental schools.

FIG. 3—MOTOR SHOWING DETACHABLE DOUBLE-PIN TYPE

Miners' Electric Lamp

An electric lamp designed for use by miners consists essentially of a lead-plate battery carried on a belt, a 0.75-cp tungsten lamp equipped with a suitable reflector which is held in a steel shell carried on the cap, and a cable connecting the battery to the lamp. The manufacturers declare that by adequate insulation of the entire circuit, placing all the terminals and contacts inside of locked and sealed steel cases and providing automatic means for extinguishing instantly the glow of the filament in case the lamp bulb is broken and the filament is exposed to the air, the device has been made safe for operation in explosive gases.

The outfit complete weighs 3.75 lb., of which 3.5 lb. is carried on the belt and 4 oz. on the cap. The battery is rated at 7.2 amp-hr. Normally, it will light the lamp for twelve hours per charge and can be relied on, it is

MINER'S ELECTRIC LAMP

declared, to furnish light for at least ten and three-quarters hours per charge at the end of one year's service. The lamp operates at 1.9 volts and the reflector distributes the light through an angle of about 130 deg.

The battery is non-spilling and the terminals are not subject to acid corrosion. The case is of medium-hard rubber, and "Exide" plates are used. The battery box measures 6.25 in. high by 5 in. wide by 2 in. thick over all. It is of drawn-sheet steel, which is electrically welded. The cover of the box is provided with a lock, and the terminal contact block is riveted to the inside of the cover. Connection to the battery terminals is made by strong spring contacts arranged to close the circuit when the cover is shut. The cable entrance bushing is water-tight. The lamp bulb, reflector and terminal contact block are incased in a drawn-steel shell, which is copper-oxidized and enameled and is provided with a hook for attaching to the miner's cap. The reflector is of drawn steel and is white-porcelain-enameled.

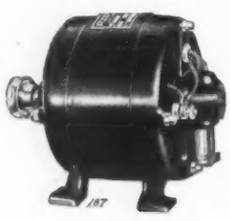
At the tip of the bulb is a duplicate contact to which the filament is connected by a fine copper wire along the outside of the glass. The bulb is held at the focal point between the contact springs, which maintain it constantly under stress, so that in case of a blow only sufficiently great to chip or partly break the bulb it will be completely shattered by the springs and drop clear of the contacts. Sufficient space is provided between the reflector and glass cover to keep broken lamp parts from short-circuiting the spring contacts. This prevents the possibility of ignition even if the cap lamp is seriously damaged amid explosive gases.

The lamp is designed so that it can be supplied to the miners from a central lamp house. The outfits are arranged so that they can be assembled and locked with the lamps burning when delivered, and so that they can be returned to the lamp house in the same condition at the end of the shift. No care or attention therefore is required of the miners.

The lamp is being made by the General Electric Company, Schenectady, N. Y.

Fractional-Horse-Power Alternating-Current Motors

Alternating-current motors with ratings of 1/20 hp, 1/12 hp, 1/8 hp, and 1/6 hp have recently been developed by the Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., particularly for operating its flashers, although they are also well adapted for use with washing machines and other types of apparatus operated by fractional-horse-power machines. The motors are of the induction type and operate on single-phase energy at 110 volts and 200 volts. The casing or frame of the motor consists of two parts. Oil grooves are cut in the bearing housings to catch surplus oil and prevent leakage, and ducts are provided to allow the overflow of oil to return to cups. The oil cups are provided with wicks which afford lubrication to the shaft and bearings. The wick is inserted in a tube so that it is held against the shaft at all times. The cup cannot be screwed in place until this wick is inserted in the tube. The rotor is of the squirrel-cage type and consists of slotted laminations, copper bars and copper conductors. According to the manufacturers, laboratory tests have shown that the motors developed an overload rating one and one-half to one and three-quarters times the full-load rating and 150 per cent to 175 per cent starting torque. The manufacturers also claim that the motors developed an efficiency of 52 per cent to 58 per cent and a power-factor of 60 per cent to 70 per cent.



ALTERNATING-CURRENT MOTOR FOR FLASHERS

Light-Weight Vacuum Cleaner

The outer motor case and nozzle of the vacuum cleaner illustrated herewith are of one-piece polished aluminum. The fan operates at 9000 r.p.m. and is driven by a General Electric motor, which is cooled by air from the fan. The motor operates on either direct current or alternating current and is inclosed in a dust-proof aluminum case. A gear-driven brush is inclosed in the nozzle to pick up lint, thread, etc., from the floor. The nozzle is so designed that it adjusts itself to any angle at which the cleaner may be operated. All wires except that running to the lamp sockets are inclosed, and the current is controlled by a press-the-button switch in the pistol-grip handle. The dust sack is of the quick-detachable type. Various kinds of attachments are also provided for cleaning portiêres, curtains, wall coverings, upholstered furniture, etc. The vacuum cleaner is being made by the Doty Manufacturing Company, Dayton, Ohio.

Ground Clamp

The ground clamp shown herewith consists of two strips of brass. The longer strip is provided with a lug at one end, to which a brass clamping screw is attached, and also a slot 1.5 in. by 3/8 in. in size. The opposite end of this strip is narrow, and when the strip is bent the end fits in the slot. The smaller strip is provided with a lug for clamping at one end and a triangular eyelet at the other end. When installed on the pipe or conduit to be grounded, the longer strip is placed in position first in such a way that the narrow end passes through the slot. The shorter strip is then attached to the end of the larger strip and is then bent around until the lugs are in line, so that the clamping screw can be placed in position. As the screw is tightened the ends are drawn together, and the shorter strip draws the narrowed end of the longer strip through the slot, thus reducing the circumference of the band until it is tightened on the pipe or conduit. The lug for connecting the ground wire is formed on the outer strip as shown in the illustration, and it is large enough

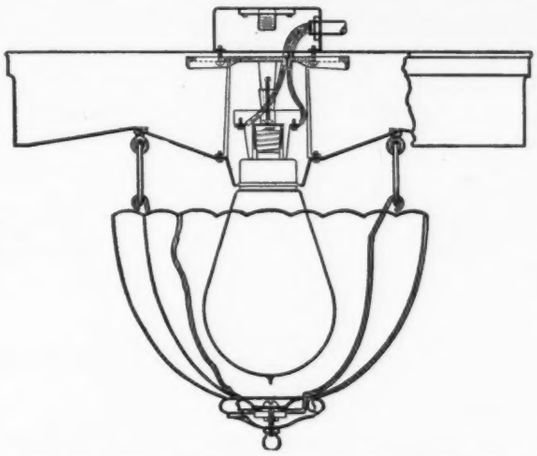
BRASS GROUND CLAMP

to take a No. 4 B. & S. wire. The clamps are made with widths of ⅝ in. and ⅞ in. and No. 20, No. 18 and No. 16 gages. They are being placed on the market by Frederick Rall, general sales agent, 19 Park Place, New York.

Semi-Indirect Lighting Fixture

In the accompanying illustration is shown a cross-sectional view of a semi-indirect lighting unit recently developed by the Frank Adam Electric Company, St. Louis, Mo. The fixture is equipped with a top reflector which is so designed that the light is reflected downwardly at a rather abrupt angle to a horizontal plane. The top reflector is provided with two independent reflecting surfaces which are disposed at a slight angle with relation to each other and also with relation to a horizontal plane.

The surface on the outer edge of the reflector is so arranged that the rays are projected outwardly and downwardly at such an angle that they are concentrated instead of being thrown outwardly in a plane



CROSS-SECTION SEMI-INDIRECT LIGHTING UNIT

approximately parallel to the ceiling. The inner reflecting surface causes a large volume of the light reflected from the translucent shield to be projected downwardly through the glass without striking or passing through the lamp bulb. The fixture is so designed that none of the direct rays from the lamp can escape without striking the translucent shield or the top reflector, thus eliminating intense horizontal glare. The reflecting surface is of porcelain enamel, which is fused on at a temperature of 1800 deg. Fahr. The reflecting surface is well adapted, it is declared, for use with nitrogen-filled lamps.

A collapsible tripod is attached to a metal cap for holding the translucent shade. The cap is well ventilated, the manufacturers claim, and the upper reflecting surface is so designed that it does not cast a shadow below the unit. The fixture is attached to the ears of the outlet box as shown in the illustration. Should it be desired to attach the unit to a fixture stem, a knockout is removed and it is fitted with an extension piece and lock-nut. In installing the unit two screws are removed from the housing from the back section, and then the back section containing the receptacle is attached to the outlet box. The wires are then connected to the receptacle, the housing is replaced, and the two screws are reinserted. Finally, the reflector is attached to the housing by four machine screws. For a 200-watt or 300-watt nitrogen-filled lamp the outer diameter of the fixture is 16 in. and that of the bowl 8.75 in.; for 400-watt or 500-watt lamps the outer diameter is 20 in. and that of the bowl 12 in.; for 750-watt or 1000-watt lamps the outer diameter is 24 in. and that of the bowl 13.25 in.

Plate-Glass Sign Illuminated by Invisible Means

A combined plate-glass sign and concealed illuminator has been developed recently, the display on which can be illuminated in any color desired without exposing the source of light. The device consists of a horizontal nickeled cylinder containing a straight-filament

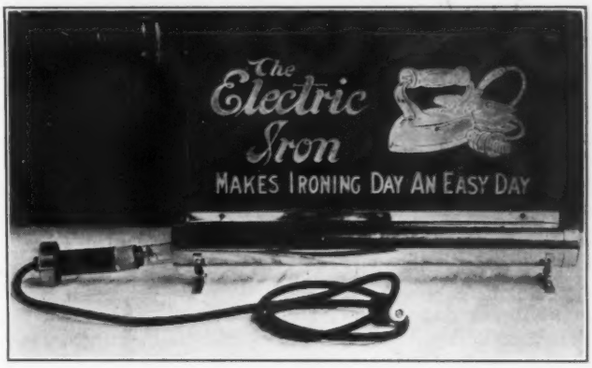


FIG. 1—GLASS SIGN WITH ILLUMINATED LETTERS

tubular lamp and supporting in a vertical plane a plate of transparent glass on the back of which is etched the display. The lamp is supported so that the light rays are compelled to stay within the glass except where they strike the etched surfaces of the display. To confine the light rays to the body of the glass it has been necessary to direct the rays from the lamp against the lower edge of the plate glass at approximately right angles. By doing so the angles of incidence inside the glass are kept at values large enough to prevent any light emerging from the glass except where rays strike etched surfaces, which are thereby illuminated. The color of the illuminated surfaces is controlled by a light-filtering composition applied to the lower edge of the glass plate.

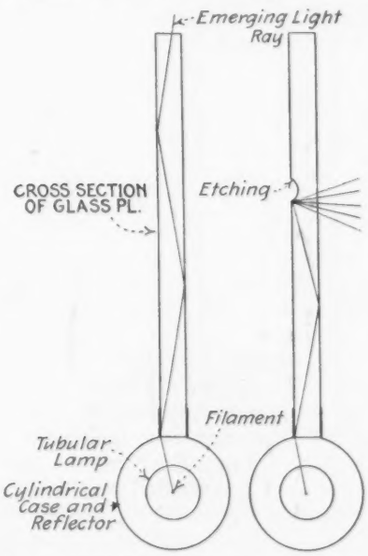


FIG. 2—ARRANGEMENT OF APPARATUS

When the lamp is lighted the display appears to be shaded as the illumination is more intense on the bottom. The color of the light can be changed by applying different light-filtering compositions to the edge of the plate. The equipment is being marketed by the Thos. Cusack Company, 949 Broadway, New York City.

CURRENT NEWS SECTION

Members of the Federal Trade Commission

President Wilson has sent to the Senate the names of his appointees to the Federal Trade Commission. They are as follows:

Messrs. Joseph E. Davies, of Wisconsin, now Commissioner of Corporations, to serve seven years; Edward N. Hurley, of Chicago, six years; William J. Harris, of Georgia, Director of the Census, five years; Will H. Parry, of Washington State, four years, and George Rublee, of New Hampshire, three years. The first three are Democrats and the last two are known as Progressives, although President Wilson indicated to callers that he regards Messrs. Parry and Rublee as Republicans. Mr. George L. Record, of New Jersey, whom President Wilson was considering for appointment to the commission, will be named as counsel, with the same salary, $10,000 a year, as the commissioners.

The nominations have been referred to Senator Newlands' committee. He said that he believed the Senate would confirm the appointees before March 4. The names have been given to a sub-committee for scrutiny. This committee is composed of Senators Pomerene, Robinson, Saulsbury, Townsend and LaFollette.

The Democrats in Congress regard the commissioners as satisfactory, and as they have the votes necessary for confirmation, both in committee and on the floor, it may be that Republican opposition to Messrs. Parry and Rublee will not be carried to an obstructive extent so far as confirmation is concerned. Senator Sherman, of Illinois, who is opposed to Mr. Hurley, was the first to announce the view that it will not be worth while to "tilt at windmills" in an effort to block confirmation. A favorable report on the commission is expected from the committee daily.

New York Commission on Underwriters' Approval of Installation

An electric corporation may not arbitrarily cut off energy from a consumer without evidence that the consumer's wiring is unsafe, and merely because the consumer refuses to furnish affirmative evidence of continued safety in the form of a certificate from a particularly designated unofficial organization like the Underwriters' association, according to an order of the New York Public Service Commission, Second District. The commission says that it is doubtless the right and probably the duty of an electric corporation in the interest of public safety to satisfy itself that a private electric installation is safe before it supplies energy thereto and to impose regulations for its continued safety. In the particular case under consideration the commission indicates that the company has gone too far and orders the service supplied as previously.

The complaint was brought by Mr. Brenton M. Ryder, proprietor of a hotel at Richmondville, Schoharie County, against the Great Bear Light & Power Company. The company had been supplying the hotel with energy for a number of years when, in December, it sent a letter informing its patrons that "the high courts have recently handed down decisions against some of the large electric-light companies which had furnished energy to consumers without Underwriters' inspection permits, holding them responsible for fires which had been traced to electric wires from improper installation." The letter requested customers to secure these permits from the secretary of the Underwriters in Schenectady, but Mr. Ryder refused to do this himself, claiming that the company had been supplying him right along and saying that he refused to be "grafted on." He did not, however, refuse to allow the company's representatives to inspect his wiring. By ordering the service restored the commission refuses to make the company place the burden of proof of the safety of his installation, where the installation has proved safe through actual usage, on the customer.

Transportation Arrangements for N. E. L. A. Convention

Arrangements have practically been completed with the various railroads, hotels and others concerned in the operation of the special trains to San Francisco and the care of the party in connection with the National Electric Light Association convention June 7 to 11. Two of the special trains will go to San Francisco over the Southern roads. Plans have been perfected for the entrance and stay of two days in the Yosemite Valley, California. Most of those who visit this national park prefer to sleep in the various tent cities. The tents have hard-wood floors and are electrically lighted.

A special train on account of the convention will be run from Los Angeles and southern California points. Central-station companies of Los Angeles and other cities in southern California and the Jovian Electrical League of Los Angeles are interested in this train.

The transportation committee advises all who plan to attend the convention to communicate at once with the hotel committee in order to secure the necessary accommodations for the stay in San Francisco.

Opportunity for Electric Vehicles in Mail Service

The Post Office Department has prepared advertisements inviting proposals for the service of carrying the mails in regulation screen wagons and for the service of furnishing the equipments for carrying the mails in cities and towns in the States of Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa and Missouri, from July 1, 1915, to June 30, 1919. Proposals will be received by the Second Assistant Postmaster General, Washington, until 4:30 p. m. April 16, and decisions will be announced on or before May 3.

Requirements are for regulation screen-wagon, mail-messenger, transfer and mail-station service between the post offices and railroad stations, terminal railway post offices, steamboat landings, mail stations, points of exchange with electric or cable cars, etc., and for screen-wagon, city-delivery and collection service. It is announced that proposals to perform service on any of the routes named in the advertisements in automobiles of such style and construction as may be acceptable to the Second Assistant Postmaster General, instead of in wagons drawn by horses, will be received. Each proposal must be accompanied with a statement giving a description of the motor vehicle it is proposed to use,

with the horse-power of the engine and the speed per hour that will be made. In the event of the proposal for automobile service being accepted, the department reserves the right to rearrange schedules and to change the running time so as to provide schedules better adapted to the more expeditious mode of transportation.

CITIES REQUIRING AUTOMOBILES FOR MAIL SERVICE

City	Screen Wagon						Collection and Delivery			
	1,000 lb.	1,500 lb.	2,000 lb.	3,000 lb.	4,000 lb.	6,000 lb.	750 lb.	1,000 lb.	1,500 lb.	2,000 lb.
Akron, Ohio	...	...	...	...	...	...	...	3	...	...
Cincinnati, Ohio	...	...	...	...	...	...	...	20	...	...
Cleveland, Ohio	...	...	...	...	...	...	...	12	...	...
Columbus, Ohio	...	...	7	1	...	...	...	12	...	...
Dayton, Ohio	...	...	...	...	...	...	...	1	...	...
Hamilton, Ohio	...	...	...	2	...	...	...	...	...	...
Sandusky, Ohio	...	...	...	2	...	...	1	...	...	...
Springfield, Ohio	...	...	...	...	...	...	1	...	...	...
Toledo, Ohio	...	8	...	4	...	...	...	9	...	...
Warren, Ohio	...	...	...	...	...	...	2	...	...	...
Youngstown, Ohio	...	...	...	...	...	...	...	4	...	...
Zanesville, Ohio	...	...	...	...	...	...	1	...	...	...
Evansville, Ind	...	...	...	...	...	...	...	2	...	...
Indianapolis, Ind	...	...	...	...	...	...	3-E	...	5-G	...
Marion, Ind	...	1	...	...	...	...	...	...	...	...
South Bend, Ind	...	...	1	1	...	...	...	1	...	...
Terre Haute, Ind	...	1	...	1	...	...	...	...	...	...
Bloomington, Ill	...	2	1	...	...	...	...	...	...	...
Cairo, Ill	...	...	...	3	...	...	...	...	...	...
Chicago, Ill	2	3	...	...	50	30	*	...	...	...
Danville, Ill	2	...	1	...	...	...	...	...	...	...
Decatur, Ill	1	...	1	...	...	...	...	...	...	...
Dixon, Ill	2	...	...	...	...	...	...	...	...	...
Elgin, Ill	2	...	1	...	...	...	...	...	...	...
Freeport, Ill	1	...	1	...	...	...	...	...	...	...
Galesburg, Ill	1	...	1	...	...	...	...	...	...	...
Kankakee, Ill	2	...	1	...	...	...	...	...	...	...
Peoria, Ill	2	...	1	...	...	...	...	2	...	...
Quincy, Ill	2	...	1	...	...	...	...	...	...	...
Rockford, Ill	2	...	1	...	...	...	...	...	...	...
Springfield, Ill	2	...	1	...	...	...	...	...	...	...
Bay City, Mich	...	...	...	...	...	...	...	1	...	...
Detroit, Mich	...	...	7	5	...	1	12	...	...	...
Grand Rapids, Mich	...	2	2	2	...	...	...	...	...	...
Saginaw, Mich	...	...	...	...	...	...	...	...	1	...
La Crosse, Wis	...	...	...	...	...	...	1	...	...	...
Madis on, Wis	1	...	2	...	...	...	1	...	...	...
Menasha, Wis	3	...	...	...	...	...	...	...	...	...
Milwaukee, Wis	...	...	8	...	2	...	8	...	...	...
Racine, Wis	...	...	...	3	...	...	...	...	...	...
Minneapolis, Minn	6	...	...	...	...	...	...	...	2	...
St. Paul, Minn	...	...	...	...	...	...	...	...	3	...
Burlington, Ia	1	...	1	...	...	...	...	...	...	...
Cedar Rapids, Ia	1	...	2	...	...	...	...	...	...	...
Davenport, Ia	...	...	...	...	...	...	...	1	...	...
Des Moines, Ia	...	...	...	...	...	...	...	2	...	...
Dubuque, Ia	...	...	2	...	2	...	...	...	...	...
Keokuk, Ia	1	...	1	...	...	...	...	...	...	...
Ottumwa, Ia	...	...	2	...	...	...	...	1	...	...
Waterloo, Ia	1	...	1	...	1	...	...	...	...	...
Kansas City, Mo	...	2	...	...	...	...	...	...	1	...
St. Joseph, Mo	...	...	...	...	...	...	...	2	...	...
St. Louis, Mo	...	5	...	2	...	...	11	...	12	...
Boston, Mass	...	...	...	14	...	...	...	...	...	...
New York, N. Y	...	...	...	...	...	...	...	...	...	30
Totals	35	24	47	40	55	31	41	73	24	30

*288 horse wagons.

Cities in which automobiles are specifically asked for are given in the accompanying table, together with the carrying capacity of the vehicles required. No particular type of automobile is specified.

Commercial Electric Truck Operating Costs

Operating costs of several typical electric commercial wagons were presented before the Chicago Section of the Electric Vehicle Association, Feb. 23, by Mr. R. Macrae, vehicle engineer for the Commonwealth Edison Company.

Among the trucks cited was a 1000-lb. car which is operated 8 miles to 15 miles per day in towel-delivery service. The Edison cells with which the car is equipped were charged only every other day during October, 1914, and in the thirty days of that month consumed 149 kw-hr. At 5 cents per kw-hr., the energy charge for the month amounted to $7.45, while the storage charge was $18, making the entire garage cost of this vehicle only $25.45 for the month.

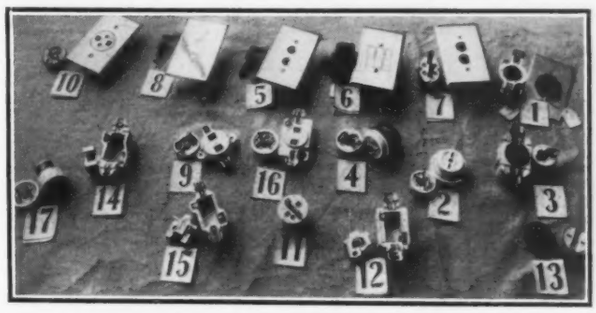
A 2-ton truck in the same garage is used for the delivery of fish by a wholesale dealer in foodstuffs. During October, 1914, this truck ran 500 miles, was charged daily, and was washed seven times. The garage bill was rendered as follows:

Garage storage	$22.00
452 kw-hr., at 5 cents	22.60
Repairing lamp	0.35
Total	$44.95

A 3000-lb. truck used for parcel delivery ran 1226 miles during a recent winter month. Heavy snow and long runs during the last week of the month required noon boosting charges on several days. The energy consumption for the month was 794 kw-hr., which, at 5 cents per kw-hr., represented an energy cost of $39.70. Added to this was the storage item of $25 (including the cost of daily washings), making the total garage costs for the month $64.70.

Standardization of Plugs and Receptacles

As previously announced in the ELECTRICAL WORLD, there will be a meeting of manufacturers of plugs and receptacles at the N. E. L. A. headquarters, New York City, at 10 a. m. on March 4, to continue the discussion of plug and receptacle standardization inaugurated at a similar meeting on Feb. 15 and reported in the ELECTRICAL WORLD of Feb. 20, page 501. In a recent statement to a representative of the ELECTRICAL WORLD in reference to these meetings, Mr. R. S. Hale, who has served as chairman in view of his heading the N. E. L. A. committee on the wiring of existing buildings, said that if these meetings can determine some standard of interchangeability of angle-pull types on the one hand and straight-pull types on the other, so that each cap of any manufacturer's angle-pull separable plug may fit any other angle-pull base part and each cap of any manufacturer's straight-pull separable plug may fit any other straight-pull base part, and particularly if this shall include changes so as to provide for polarity, then the object of the National Electric Light Association will be attained as nearly as possible until the industry shall be ready to give up either the angle-pull or straight-pull types.



VARIOUS TYPES OF PLUGS AND RECEPTACLES

All that the association now desires to accomplish, in brief, is such interconnectability that the purchaser of a flatiron or portable lamp or similar device for use on a lighting circuit by means of a cord and plug shall find he can use his purchase all through his house without having to get another plug. There is a feeling among some of the central stations that the committee on the

wiring of existing buildings ought to have accomplished more toward standardization, and while the committee recognizes the patent and commercial difficulties, it feels that there is serious danger that some of the central stations may get together independently of the committee and standardize on some particular type of plug and receptacle without regard to patents or other considerations. In addition to the manufacturers who have been represented at the previous conference, all others will be welcome who do now, or who intend to, manufacture either of these types or any types which should be considered.

To illustrate the lack of interchangeability of many plugs and receptacles, the accompanying halftone has been prepared by the ELECTRICAL WORLD, covering thirty-two thoroughly modern equipments in seventeen groups. In examining this illustration it should be borne in mind that the designers of the individual plugs and receptacles aimed to meet a particular service requirement in each case, and that the capacity and to some degree the adaptability of the fittings shown vary in relation to different conditions of installation. Nevertheless, the importance of standardization is clearly evident. The equipment shown is as follows, the name of the manufacturer being given in each case:

No. 1—Edison base, flush receptacle—Trumbull.
No. 2—Plug and receptacle, 10 amp—Hubbell.
No. 3—Flush receptacle and plug, 10 amp, 250 volts—Hubbell.
No. 4—Plug and receptacle, 660 watts—Federal.
No. 5—Plug and receptacle, flush type—Hart & Hegeman.
No. 6—Plug and receptacle, 15 amp—Metropolitan.
No. 7—Plug and receptacle, 10 amp—Metropolitan.
No. 8—Receptacle and plug, "Diamond H"—Hart Manufacturing Company.
No. 9—Plug and receptacle—Manhattan.
No. 10—Plug and receptacle, flush type—Manhattan.
No. 11—Adapter plug, with Edison base—Manhattan.
No. 12—Flush plug and receptacle—Chelten.
No. 13—Plug and receptacle, 660 watts—National Metal Moulding.
No. 14—Plug and receptacle—Arrow Electric Company.
Nos. 15, 16, 17—Plugs and receptacles—General Electric Company.

Increase in Alternating-Current Service in New York

In an address made to the employees of the company recently, Mr. J. F. Becker, general sales agent of the United Electric Light & Power Company of New York, showed the splendid increase in business secured by that company during 1914 over 1913 despite the fact that New York with its immense exporting houses probably suffered worse than other cities in the business depression due to the breaking out of hostilities between the great nations of Europe. It should be pointed out that the United Electric Light & Power Company distributes alternating current in the borough of Manhattan in competition with the direct current of the New York Edison Company, although the company is without competition in the Washington Heights section of the borough. That section of the borough is made up almost exclusively of apartment houses and stores.

Fig. 1 shows the actual new business signed up by the sales department in 1913 and 1914. The new business secured during the past five years is shown in Fig. 2, where the increased activities of 1914 are readily apparent. Fig. 3, which gives the total kw-hr. sold during the past five years, shows an abnormal increase from 45,000,000 kw-hr. to 107,000,000 kw-hr. during the past year. This increase however was not altogether attributable to the efforts of the sales department since it includes also the high-tension energy sold to a number of lighting companies in the vicinity of Manhattan, which load was taken on after the starting of the company's 201st Street generating station. The total increase for commercial purposes only was approximately 11 per cent. The revenue from energy for 1914 was approximately $3,750,000.

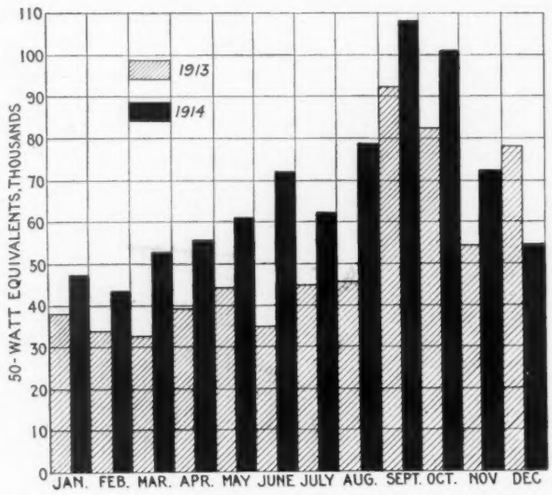


FIG. 1—OUTPUT IN 1913 AND 1914 COMPARED BY MONTHS

The company maintains an appliance bureau where devices are sold for profit, and last year the sales increased 81 per cent as compared with 1913, with an increase in selling price of approximately 127 per cent. Special sales campaigns are carried on from time to time with special advertising literature for the purpose. The co-operation of electrical dealers and contractors is also secured on these sales, the company placing the articles to be sold with the contractors and dealers at a price sufficient for them to make a substantial profit for handling, selling and distributing. Over 1200 irons were thus sold in a single campaign.

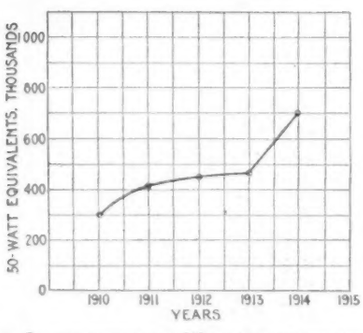


FIG. 2—GROWTH IN 50-WATT EQUIVALENTS

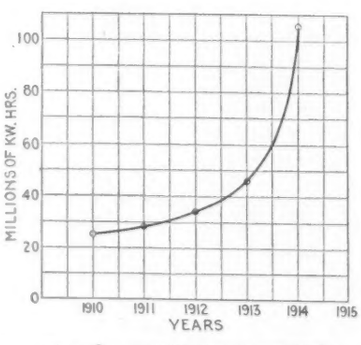


FIG. 3—GROWTH IN OUTPUT

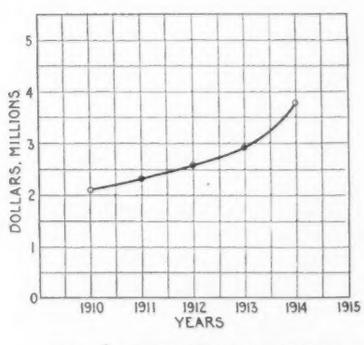


FIG. 4—GROWTH IN INCOME

Pacific Gas & Electric Company Valuation Methods

Speaking before the Worcester (Mass.) Polytechnic Institute branch of the American Institute of Electrical Engineers on Feb. 19, Mr. George H. Throop, of the J. G. White Engineering Corporation, New York, described a complete appraisal of the Pacific Gas & Electric Company of California. In anticipation of the public utilities act of 1912, the company engaged the White organization to value its property in order to give it sufficient data to justify its rates in any rate hearing before the new commission, to facilitate additional financing, and to check the assessed values of property for taxation.

At the time of appraisal the outstanding securities totalled about $100,000,000. Operations covered thirty counties, representing an area of 37,950 sq. miles, including 212 municipalities with a total population of over 1,100,000. Electrical energy was furnished in 205 of these places, gas in fifty-five, water in nineteen, and street-railway service in one, while water was supplied for several irrigation systems. The company operated 1320 miles of high-tension line, mostly at 60,000 volts, and energy was generated in nine hydroelectric plants with a combined rating of 68,030 kw, exclusive of the old Rome and Auburn generating stations. There were also four steam plants with a total rating of 69,700 kw, 135 substations with 245,000 kw total rating, and 1850 miles of gas mains, 124 miles of high-pressure gas pipe, and in the six larger cities over 410 miles of underground cable. In the electrical distribution systems were 71,500 poles, or over 1500 miles of pole line, and there were 638 miles of pole line between towns and in country districts supplying power for irrigation pumping, gold dredging, etc. The street railway, that of Sacramento, operated about 35 miles of track.

The valuation was started in April, 1911. About a month was spent in making forms, obtaining data and maps and getting an organization together. The field inventory was begun in the last week of May and completed early in the following September. The work of arranging and tabulating the field inventory data and of determining material and labor unit costs was carried on contemporaneously with the field work. After the latter was completed the organization finished the computation of quantities, applied unit costs and tabulated results. The valuation was completed in July, 1912. It was segregated by counties and municipal divisions and subdivided according to the company's system of accounts.

The work was divided into four departments—hydraulic, steam power, gas and water works, and electric and street railway. It was in general charge of Mr. T. C. Gillespie, and the departments were headed respectively by Messrs. Rhodes, Gay, Broadnax and Throop, of the White organization. The assistants included engineers, recent graduates from Stanford University, and some undergraduates. From forty to sixty men were engaged.

The hydraulic department worked in four parties, two on power plants and headworks and two on flumes and ditches. Each party was in charge of an experienced engineer. One party was sufficient for the inventory of steam plants. The inventory of gas and municipal water systems was taken by two parties—one for gas works and buildings and one for mains and distributing systems. In the electrical department two men made the inventory of all substations and electrical equipment of generating plants. Two men inventoried the transmission lines, and ten to twelve men, divided into two parties, made the inventory of the distribution system. Appraisals of real estate were made by local firms and checked with recent sales and the company's records.

Each man was given a complete set of detailed typewritten instructions and sets of forms for the inventory. All members of the field parties mailed to the San Francisco office daily time cards, and the chief of each party kept the main office advised as to progress. Thus it was possible to determine whether the work was on schedule time.

Each building was measured and complete bills of materials were drawn off. Sketches of each were made in the field on quadrilateral ruled paper to scales of from 10 ft. to 20 ft. per inch. A light, jointed bamboo rod was used for vertical measurements and other measurements were made with tape and rule. The sketches gave plan, elevation and cross-section and showed the construction in considerable detail, but only main dimensions were shown and no attempt was made to mark such details as size and number of joists, rafters, roof trusses, etc. After the sketches were completed one man would measure and call off the material and a second man would list it, with the sketches before him, noting the length. The men became adept, and the time required to make sketches did not exceed that required to check up blueprints and make corrections due to changes in plans.

In the inventory of gas mains recourse had to be had to the company's records, which were checked against each other. All mains and services were plotted on large-scale maps and were checked with work orders as far as possible, and then gas consumers, as determined from meter readers' books, were plotted on the maps.

For the inventory of power-station and substation equipment loose-leaf binders were provided. In the front were general instructions. Equipment was classified under generators, motor-generators, transformers, etc. On the back of each section sheet were typewritten the items for notation and an example. After inventory the sheets could be assembled in proper order.

In the inventory of overhead lines each man was accompanied by a lineman familiar with the district who climbed poles when necessary to ascertain sizes of wire, rating of transformers, etc. On a map drawn to a scale of 200 ft. to 1 in. each pole was numbered. On the inventory sheet the corresponding number was marked in the first column, and the size of pole, number and size of guys, cross-arms, insulators, wire insulators, transformers, etc., were stated. The forms were ruled in forty-three vertical columns with appropriate headings. Forms for miscellaneous data, such as platforms for carrying large transformers, were carried in a separate holder or loose-leaf binder.

The name of the town was written at the top of each sheet, with the initials of the man making the inventory and the date. A book number was assigned to each town or district, and all sheets were numbered accordingly. These sheets were assembled and bound, forming a permanent record. The totals at the bottom of the page were transferred to summary sheets and the grand totals transferred to the valuation sheets. Similar forms were used in the inventory of transmission lines. On distribution lines the men averaged about 200 poles a day each, and on transmission lines about 8 to 10 miles a day, except in mountainous country, where it was sometimes necessary to make a detour. The record for a day's work was 30 miles of transmission line, the distribution system of a town of 200 inhabitants, and the substation equipment. The 30 miles were covered on a motorcycle and the poles registered by a hand counter.

Unit labor costs were worked up from construction records. Unit material costs were obtained from records and by means of quotations from manufacturers. Transcontinental and local freight rates were tabulated for all commodities, and the cost of hauling, which was a considerable item in hydroelectric construction, was also

worked up. Present prices of material and labor were adopted, except for copper and cast-iron pipe, where the average for the five previous years was used. To the cost of material and labor overhead charges to cover administration, interest and taxes during construction, engineering and supervision, contingencies, liability insurance, loss and breakage of tools and omissions and errors in inventory were added. The overhead charges were applied to each item, and ranged from 15 to 28 per cent, depending upon the class of material or construction. The unit costs were sufficient to provide for a fair proportion of piecemeal construction, or for contractor's profit on extensive construction work, such as hydraulic developments. An allowance of 4 per cent on cost of material was added to cover storeroom expenses. This was obtained from the company's records for several years.

The valuation was segregated according to the company classification of accounts, which followed closely the classifications of the Wisconsin and New York commissions, modified to suit California conditions. This enabled the company to determine interest and depreciation charges on costs of power at the generating-station switchboard, of transmission to local substations, and of distribution to consumers' meters.

Interest on Cleveland Municipal Plant Bonds

When asked regarding a newspaper statement said to be from the report of a state examiner to the effect that no provision had been made for paying interest charges on the bonds of the municipal light plant at Cleveland, Ohio, Commissioner of Light and Heat F. W. Ballard stated that he would issue a bulletin within two or three weeks that will cover these criticisms fully and explain the plans that are in hand. He said, however, that he could not give out any of the matter to be used in advance.

The newspaper stated that the sinking-fund commission had already paid $100,000 out of the general tax fund to meet the interest on $2,500,000 of the bonds.

Promoting National Electrical Week

Much publicity has been given by daily newspapers throughout the country to the plan for a "national electrical week" which the Society for Electrical Development is promoting. Following the meeting of the directors of the Society Feb. 17, which was mentioned in the ELECTRICAL WORLD of Feb. 20, accounts of the plans were sent by the national press associations to daily newspapers in all sections of the country. The suggestion that National Electrical Week be regarded as a prosperity week attracted the attention of newspapers, and widespread approval was given to the idea. Articles 1500 words in length were telegraphed from New York by special correspondents for out-of-town newspapers, and the news was given prominent space in the large daily papers everywhere.

More detailed plans for promotion of the movement are under consideration by the Society for Electrical Development. The co-operation of national electrical associations will, it is expected, be a great factor in the success of the plans. The society has received a letter from the International Association of Display Men promising support and co-operation. This association is composed of men who have charge of displays in windows of stores in all sections of the country, and their co-operation assures desirable window displays of electrical appliances.

"Prosperity week," as conceived by the Society for Electrical Development, has been brought to the attention of President Wilson. It is the idea of the President that such a move would be desirable, and that prosperity ought not only to be proclaimed for a week but that the electrical industry should bring about a full year of it.

Meeting of N. E. L. A. Wiring Committee

Plans have been perfected for the meeting of the N. E. L. A. committee on the wiring of existing buildings, which will be held at the Edison Service Buildings, 1165 Massachusetts Avenue, Boston, Mass., on March 5, at 10 a. m. The program includes consideration of a report from Chairman R. S. Hale on plugs and receptacles, based upon the meetings of manufacturers in New York on Feb. 15 and March 4; the presentation by Mr. H. E. Eisenmenger, Cleveland, Ohio, of a study of present costs of wiring; a discussion of the condition of affairs relative to the wiring handbook and Cushing's Manual; consideration of bare concentric wire, of increasing the permissible size of fuses on branch circuits to 15 amp, of the standardization of size, type and marking of fuse holders for branch circuits, and of the standardization of screw threads for lamp bases; discussion of changes in the National Electrical Code to be considered at the March meeting of the Underwriters, and consideration of whether it will help or discourage development if, on the one hand, the manufacturers of fittings for bare concentric wire agree immediately on standard dimensions for the fittings, or if, on the other hand, each is left free to work out the best sizes, while standardization is deferred until experience shows which is best.

BARE CONCENTRIC WIRE

Mr. R. S. Hale Shows the Advantages of the Wire and the Opportunities It Offers of Increasing the Business of the Manufacturer, Lighting Company and Contractor

At a meeting of the Kilowatt Club of Brooklyn, N. Y., on Feb. 25, Mr. R. S. Hale, of Boston, Mass., chairman of the N. E. L. A. committee on the wiring of existing buildings, presented a paper on bare concentric wiring, discussing the movement toward the use of this new type of equipment along broad general lines. The author pointed out that there are almost the classic fifty-seven varieties of the new wire, suited to varied conditions. Although many varieties have been developed, there is no doubt that American genius will produce further improvements beyond anything that has yet been accomplished, provided that the industry shall have a reasonable chance to experiment with the material.

It is not intended to seek a change in the National Electrical Code itself next month, but to provide for acquiring experience under the proper conditions. It is "up to" the contractors, or at least to some of the central stations, to let the manufacturers know that it is proposed to keep America at the front, and it will then be the duty of the manufacturers to make enough wire and fittings to equip buildings and provide real field experience. The movement is not one for cheap wiring except in the sense that electricity is getting to be a cheaper light than gas, candles and pine knots. It is really a movement for more wiring, and just as the farmer tries to make two blades of grass grow where only one grew before, so the sponsors of concentric wiring hope to make five outlets grow for each one now supplied. It is believed that the movement will result in a great deal more work for the wireman than ever before.

Small Number of Dwellings Wired

Mr. Hale reviewed the history of the movement for lower-cost wiring, describing the installations successful in Europe as investigated by Messrs. S. E. Doane, E. W. Lloyd and himself, and pointing out the relatively small development in this country along the lines of electrical service in old buildings. In New York City less than 10 per cent of the residences and apartments, with the exception of expensive elevator apartments, have electric service; in Chicago less than 16 per cent of the single dwellings and only about one-third of the apartments have service, and in Boston it is estimated that there are 160,000 unwired houses and apartments, and these are being equipped at the rate of only 3000 per year at present. He discussed the successful rise of the unit price system in house wiring, through agreement between the central station and wiring contractors, on the basis that such prices shall neither be so high as to check business nor so low as not to give a fair profit to the wiring contractor after allowing for any saving he may make in selling expense and bad debts.

In certain European cities, notably Strassburg and Milan, the development of central-station customers exceeds that of Brooklyn, though with less than one-third the population. Gas is even lower than in America, 60 cents to 70 cents per 1000 ft., and electricity is higher. In Strassburg it is practically 10 cents, and the customer has in addition to pay for all his lamps and meet a government tax on each lamp, and further has to pay meter rent, which would make the net rate roughly 100 per cent higher for the small consumer than here. In these cities the class of people that live on wages of $10 and even $5 a week use electricity as customers of the central stations. Mr. Hale outlined the use of bare concentric wiring in these cities and pointed out that even insurance companies abroad are wiring their offices with this type of equipment. On account of the numerous varieties, it was thought best not to ask to have the National Electrical Code changed so as to let all these systems into this country, but instead to get at least one manufacturer to present one of the systems to the Underwriters here to be tried. The work of the General Electric Company in experimentally studying the bare concentric system has been particularly helpful. As a result of recent work along these lines, it has been decided to offer the new section of the proposed wiring rules as an experimental code by which actual field experience can be attained under proper supervision and reports.

The new wire will undoubtedly be a severe blow to both wood and metal molding, since it can be used in nearly all cases where molding is now employed and will, in the estimation of Mr. Hale, be much cheaper, safer and less conspicuous. The investment in tools and plant for making wood molding is not important, at least as regards molding for electric wires, while the metal-molding manufacturers will probably find that many of their fittings can be used for the new wire with but slight changes and that their factories, many of their tools and their organization can be used for making and selling new wire without great expense for the change-over. It is not believed by the author that the new wire will interfere with the sale of conduit, which is extensively used abroad and is more applicable than bare concentric wire to new buildings. The field for the new wire will be almost exclusively in buildings that would not be wired at all if conduit were obligatory and will give an impetus to the industry as a whole which will lead to the use of more conduit than ever. Other manufacturers are taking up the matter with interest, and the adaptability of the wire to existing fittings renders it likely that before long the less expensive fittings that the new system makes possible will be developed and made available. Tentative specifications and prices have already been made by a prospective manufacturer of bare concentric wire to be placed on the market in competition with existing equipment.

Restrict Use to Branch Circuits

After describing the main features of bare concentric wire, Mr. Hale suggested that for a time the new wire will be used only for branch and tap circuits, but in time it may be used elsewhere. It will probably not be used in new buildings for some time, but only in old buildings where open cleat wiring is not desirable and where the cost of concealed wiring is prohibitive. It looks now as though the cost of the wire itself would be about the same per circuit foot as the present code wire, and much less than the cost of concealed work or molding. To the extent that the present fittings are used their cost will be the same, or possibly a shade more, on account of certain very cheap cross-overs or connectors to be used for making joints, but the new system holds possibilities in the way of improved design. It is possible that later the new wire will be installed in conduit with a slight reduction in the amount of labor and increase in safety. The new wire can be used only on grounded systems, and any old-fashioned central station or isolated plant that has not one side or the neutral grounded cannot use it. However, since any such plant, if of less than 150 volts, is breaking the insurance rules anyway, this is not a serious handicap to the spread of the new wire.

The new wire will be used, largely for exposed work, running the inconspicuous wires along the surface of the walls, in the corners next to picture molding, etc., but ultimately it is likely to be used for concealed work. One method used abroad is to cut a narrow channel in the plaster for the wire and then to paper over it, and while there might be a possibility of corrosion, no reports of this have as yet been received. The new wire will involve distinctly more care in installation than the present methods and will therefore be confined to comparatively expert workmen who will possibly command higher wages per day than men who can use only the present methods, although they will work so much faster that the cost per outlet should be less. There is no question that the janitor, chauffeur and schoolboy who now feel warranted in twisting two wires together to form a joint will find themselves "stumped" by the new wire until they have received some instructions. One reason why more expert workmen will be needed is that great care must be given to the polarity so that the wire that carries potential shall not be exposed in any case. The result will be that it will be almost impossible to get even a 110-volt shock and almost impossible to get any connection on the potential-carrying wire except a dead short-circuit that will blow the fuse at once.

Various Types of Concentric Wire

There are at least three types of concentric, bare wire. All have a copper core which may be solid or stranded, then insulation, which usually has some rubber and may have braid and also paper or cambric. The return wire may be a water-tight tube or sheath, or may have a water-tight seam or be braided with fine wires. The smooth water-tight sheath is simplest as regards connections and also is best for moist places or the lighting around oily machinery. For boiler rooms and other hot places the insulation can be of asbestos, and for dry places the non-water-tight construction is probably just as good and cheaper. Almost any American fitting can be used with some arrangement for a cross-over or connection between the outside conductor at joints or connections, which is very simple where soft solder is used. Hard solder requires so much heat that it injures the rubber insulation and is forbidden in

the experimental rules. The new construction will do away with the need for insulating joints on gas fixtures, previous to doing away with the need of gas fixtures themselves. While there will always be use for conduit, as regards old houses, wiremen would rather get five jobs at $30 than one at $45, manufacturers would rather make more wire and fittings, and central stations would rather serve every house on a street than merely take the new houses and wait for the older ones to be rebuilt. The new system is by no means for cheap houses only, but should also have a future in good residences.

Financing of Commonwealth Edison Company

In the annual report of the Commonwealth Edison Company of Chicago covering the year 1914 the large increase in operating revenue is attributed mainly to the additional elevated and surface electric-railway business, the acquisition of companies served previously by the Cosmopolitan Electric Company, and to an exceptional increase of about 40,000 other customers, although in the depression of the latter part of last year many customers used less energy than under normal conditions. The profit from increased business was offset largely by reductions in rates. The reductions for retail customers during the year amounted to approximately $775,000. The reduction in motor-service rates to large consumers amounted approximately to $90,000.

The company issued during the year $7,000,000 of one-year 5 per cent notes. When the voluntary association known as the Chicago Elevated Railways Collateral Trust was formed in 1911 as a step in unification of the elevated railways and eventual amalgamation with the surface electric railways, the company had the alternative of making a conditional guarantee of substantially $6,000,000 to facilitate the necessary financing, or of seeing some other and possibly competing organization make such a guarantee and thereby obtain for a long period of years, probably, the entire business of supplying the local elevated and surface electric railways with electrical energy. The menacing risk of a possible competitor starting business with the railways as customers, taking electrical energy equivalent to all of the rest of the company's output at that time, had long been foreseen and understood. It appeared that the aggregate business which could be secured from the railways in consequence of the guarantee and under long-term contracts promised to be about $100,000,000, that the guaranteed amount would have to be paid only in case there should be no amalgamation of the elevated and surface electric railways before July 1, 1914, and that the company would receive, in addition to the business, common participating shares of the association equal to nearly one-half of the preferred and common shares to be issued. It was decided to make the conditional guarantee and, as the amalgamation was not perfected, payment became obligatory on July 1, 1914. The company agreed to take at par an amount of a proposed issue of ten-year 6 per cent debentures of the association sufficient to make its entire investment $7,000,000. The company issued its notes secured by pledge of its 200,996.814 common participation shares of the association and its $1,270,000 of association debentures. The business expected to come directly from the contract with the elevated and surface electric railway companies now seems likely to amount to not less than $125,000,000.

"The great volume of this business," the report adds, "will permit the company to obtain a reasonable profit which it could not have enjoyed without the business, and it will enable the company to furnish the electrical power at rates which cannot fairly be questioned, thus justifying the burden assumed as a means of procuring the business. The contract rates are mutually satisfactory to all the companies concerned, and have, together with the contract provisions, been approved by disinterested engineering experts of high standing to whom they were submitted."

Cleveland Energy for Railway Operation

During 1914 the Cleveland Railway Company purchased from the Cleveland Electric Illuminating Company more than 40 per cent of the electrical energy used in operation of the road. The railway company generated in its power plants 70,364,626 kw-hr. and purchased from the illuminating company 49,984,590 kw-hr. The cost of energy purchased by the railway in the year was $359,470, which indicates an average rate therefore of 7.19 mills per kw-hr.

Exhaust steam is sold by the railway company to the Cleveland Salt Company under a contract which will expire on July 1. It is recommended by the electrical engineer of the railway that the steam be utilized in operation of a 4000-kw steam turbine generator. It is estimated that the expenditure of $200,000 for this purpose would return about 36 per cent on the investment—much in excess of the amount received from the salt company. The recommendation will be discussed with the city street railroad commission, and any proposition from the salt company will also be considered.

New York Telephone Valuation

Testifying before the legislative committee which is investigating New York Telephone Company rates, Mr. H. P. Gillette, a member of the appraisal committee of the company, submitted a statement showing that the valuation of the physical property of the company in New York City is $99,925,934. This is based on reproduction cost as of June 30, 1914, and is as follows: Telephone plant as per revised tax record, $73,889,507; plant in service but bills not rendered to telephone company, $300,000; liability insurance, $621,000; telephone directories, library, working records, etc., $773,068; working cash capital, $3,000,000; total, $78,583,575; overhead charges (executive, administration, engineering, interest, taxes, etc.), $14,785,000; contingencies and omissions, $3,694,475; training operators, $678,340; selling service, $2,184,544; total in Greater New York, exclusive of non-physical values and of the Empire City Subway Company, $99,925,934.

As this total compares with $65,000,000 given by Prof. Edward W. Bemis, the committee recalled Professor Bemis, who said that his figures were based on actual costs of the various items in the property, many of which were acquired when both labor and materials were much cheaper than at present. Professor Bemis declared that the plant was built up piecemeal, which would reduce the overhead charges considerably, and expressed the opinion that a corporation enjoying a monopoly of the streets is entitled to a fair return on the actual investment rather than on a hypothetical investment. He also said that the conclusions of Mr. Gillette are the preliminary estimate of a work not yet completed and include much property in course of construction.

At a continued hearing before the Public Service Commission, Second District, President Union N. Bethell of the New York Telephone Company testified that it is perfectly proper to sell stock to stockholders at par. Mr. John L. Swayze, counsel for the company, discussed the likelihood of a reduction in rates.

Miscellaneous News Notes

Toronto Electrical Show.—An electrical exposition will be held in the Arena, Toronto, from April 12 to 17. The exhibition will serve to demonstrate to the public the variety of uses of electricity in the home and elsewhere.

Dayton Utilities Fight White Plague.—The Dayton (Ohio) Power & Light Company and the Dayton Street Railway Company will co-operate with the Tuberculosis Society in its campaign against the white plague by issuing orders to their employees instructing them to report all suspected cases of tuberculosis to the health department.

Municipal Plant at Madisonville, Ohio, Unprofitable.—State Examiner Moses Blau, following an examination of the Madisonville (Ohio) electric plant, which is being operated by the city of Cincinnati, stated that the cost of operation and maintenance, including all factors which should properly be taken into account, is considerably greater than the revenue derived from the plant, and recommended that it be abandoned. Mr. Blau declared that it is necessary to spend money every year on the plant in excess of the income which it brings in.

"Buy It Now" Campaign.—A "Buy it now" campaign committee has been organized with headquarters at Omaha, Neb., to promote immediate purchases of goods. The campaign was started by the Agricultural Publishers' Association, publisher of farm papers, but it has grown rapidly and is supported by many other organizations. The committee in soliciting co-operation quotes the following from President Wilson: "If you are going to buy it, buy it now. That is a perfectly safe maxim to act upon. It is just as safe to buy it now as it ever will be, and if you start buying there will be no end to it—and you will be a seller as well as a buyer."

Storage-Battery Bus Service Extended.—The Union Electric Company, which operates both the electric-service and electric-railway lines in Dubuque, Ia., has been operating two electric passenger buses to outlying districts on a twenty-minute schedule since Sept. 7, 1914. So successful have been both the operation and the financial returns from this line that the company has purchased another truck, a duplicate of the first two, and is now maintaining a ten-minute schedule over the same route. Mr. E. M. Walker is general manager of the operating company. The trucks, which are equipped with Edison storage batteries, were sold by Mr. A. J. Brechtel, of the General Vehicle Company, Long Island City, N. Y.

Cost of Commercial Electric Vehicle Operation.—In an address before the Chicago Section of the Electric Vehicle Association, Feb. 23, Mr. R. Macrae, vehicle engineer of the Commonwealth Edison Company, Chicago, spoke on "Costs of Commercial Electric Vehicle Operation and Methods of Cost-Keeping," describing the results obtained in the Eddy garage, corner of Fulton and Halstead Streets, Chicago. This garage, which stables commercial trucks exclusively, was designed under Mr. Macrae's direction. The total absence of voltmeters on its charging switchboards is one of the features of the installation. The garage costs of maintaining a commercial car, said Mr. Macrae, vary from $25 to $75 per month. The speaker emphasized the fallacy of the plan of charging a flat monthly sum for caring for electric trucks.

Municipal Ownership Ordinance in Toledo.—An ordinance was introduced in the Toledo City Council on Feb. 13 providing for the issue of $4,000,000 bonds to acquire the light, power, heat and artificial gas properties of the Toledo Railways & Light Company, under the provisions of the initiated municipal ownership ordinance, passed on Aug. 4, 1914. The ordinance was prepared by City Solicitor Thurstin and is similar to the one he introduced some time ago relating to the railroad properties of the company. It provides for twenty-year 5 per cent bonds and contains provisions intended to safeguard the city and the bondholders. Under this ordinance rates shall be made by the Public Utilities Commission of Ohio or any other body that may be empowered to look after such duties. However, it fixes a maximum of 6 cents per kw-hr. for energy and 65 cents per 1000 cu. ft. for artificial gas. It was referred to the committee of the whole.

Associations and Societies

Engineering Society of Wisconsin.—"The Planning of Municipal Street-Lighting Systems" was the subject of a paper read by Mr. Arthur J. Sweet, of Vaughn, Meyer & Sweet, Milwaukee, Wis., before the Engineering Society of Wisconsin, at Madison, Wis., Feb. 22. Mr. Sweet's paper was illustrated by slides and models of the new lighting system proposed for Milwaukee.

Minnesota Engineers' Society.—At the annual meeting of the Minnesota Society of Surveyors and Engineers, held at the Ryan Hotel, St. Paul, Feb. 19, Mr. Harvey Dart, city engineer at Owatonna, Minn., described the luminous-arc street lighting employed at Owatanna. Mr. J. F. Druar, consulting engineer, St. Paul, presented a paper on central heating plants for small towns.

Rejuvenation of New York Jovians.—It is estimated that about 100 candidates will be initiated at the rejuvenation of the Jovian Order to be held on March 3 at the Martinique Hotel, New York. Mr. James H. Betts, statesman for New York, and Past Jupiter Frank E. Watts, as first tribune, have charge of the arrangements. Mr. C. L. Hight will serve as leader of the degree team.

Chicago Jovian League.—Mr. H. A. Morss, vice-president of the Simplex Wire & Cable Company, Boston, Mass., addressed the Chicago Jovian League, Feb. 15, describing the manufacture of rubber-covered wire and the application of braided coverings and lead and steel sheaths. Lantern slides and moving pictures taken in the Simplex factory were exhibited. About 200 Jovians and guests attended the meeting.

Electric Power Club.—At a meeting of the Electric Power Club, an organization of electric motor manufacturers, which is to be held at Cleveland, Ohio, during the present month, the topic of temperature ratings is to be discussed. According to the secretary, Mr. G. A. Roth, Roth Brothers & Company, 1410 West Adams Street, Chicago, the exact date of the meeting has not yet been settled upon.

Electrical Jobbers' Conventions.—The Electrical Supply Jobbers' Association will hold a three-day meeting at the Hotel LaSalle, Chicago, March 17 to 19. A Jovian rejuvenation is planned as a feature of the entertainment program. Mr. Franklin Overbagh, 411 South Clinton Street, Chicago, is secretary of the association. On the two days preceding the jobbers' association convention the Westinghouse agent-jobbers are to hold their spring meeting in Chicago.

Ohio Commercial Men to Meet at Dayton.—The committee on new-business co-operation of the Ohio Electric Light Association will meet at Dayton on March 17 to discuss commercial topics in the central-station field. On the preceding day, Tuesday, March 16, commercial men from Ohio and other neighboring states will meet at Dayton to complete the organization of the new Industrial Electrical Heating Association. Among the organizers of the new electric-heating association is Mr. A. K. Young, sales manager of the Toledo Railway & Light Company.

Chicago Section, E. V. A.—Mr. J. T. Hartley, sales engineer of the Sangamo Electric Company, Springfield, Ill., addressed the Chicago Section of the Electric Vehicle Association of America, Feb. 16, on the use of ampere-hour meters in electric-vehicle charging. The weekly Tuesday luncheons of the Chicago Section are now held at the Hotel Metropole, 2300 Michigan Avenue, in the center of Chicago's automobile district. Chairman McDowell has appointed as members of the committee on the subject of parcel-post delivery by means of electric vehicles Messrs. C. A. Street, Godfrey H. Atkins, Walter Wardrop and O. H. Caldwell.

San Francisco Meeting of the A. A. A. S.—A preliminary announcement has been made of the San Francisco meeting of the American Association for the Advancement of Science and affiliated societies, to be held on Aug. 2 to 7. The Pacific division of the association has issued a booklet of thirty-two pages giving an outline of the proposed sessions of the various sections and societies and listing the names of the members of the committees. Itineraries and excursions for visiting members are outlined and detailed information is given as to the costs. Mr. W. W. Campbell, Berkeley, Cal., is chairman of the Pacific Coast committee.

Baltimore Section, N. E. L. A.—At the monthly meeting of the Baltimore Section, N. E. L. A., on Feb. 17, Mr. J. C. Parker, electrical and mechanical engineer of the Rochester Railway & Light Company, delivered an address on "Public Service Corporations," dealing with the question of watered stock. Vaudeville, motion pictures and music by the company's mandolin and guitar club furnished entertainment features for the meeting.

Philadelphia Section, N. E. L. A.—Such unexpected success attended the first attempt of the Philadelphia Electric Company section of the National Electric Light Association to make its January meeting entertaining to members and the ladies of their families that it is probable "Ladies' Night" will be repeated each year hereafter. About 1400 were present. Among the entertaining features of the evening were organ recitals, vocal solos, band music, cartoon drawing, story telling, representing noted pieces of sculpture with living persons, motion pictures, dancing, etc. Prof. Francis Harvey Greene, the speaker of the evening, lectured on the subject "The Nature and Worth of Wit and Humor."

Meeting of Missouri River Club.—The Missouri River Club, composed of the electrical jobbers of the river cities of St. Joseph, Sioux City, Lincoln and Kansas City, held its quarterly meeting at Omaha, Neb., Feb. 18. Mr. Franklin Overbagh, secretary of the Electrical Supply Jobbers' Association, and Mr. M. D. Harvey, of Chicago, were present as guests of the club and addressed the meeting on the business outlook. The annual election of officers was held, and Mr. G. W. Johnston, of the Midwest Electric Company, Omaha, was chosen president. He succeeds Mr. W. R. Thomas, of St. Joseph. Mr. Harry Goodell, manager of the Western Electric Company's branch in Omaha, was elected secretary to succeed Mr. J. M. Bateman, of Omaha.

Selling the Initial Truck.—Mr. Day Baker of the General Vehicle Company spoke before the New York Section of the Electric Vehicle Association, Feb. 24, and outlined some of his experiences in selling electric vehicles in Boston and vicinity, dwelling particularly on the first sale to a customer. Mr. Baker asserted that great care must be taken to satisfy the buyer from the start, and that it is necessary to keep in touch with him to see that he is using his cars to the best advantage. Messrs. D. F. Tobias, H. Robinson, D. C. Fenner, F. B. Neely and R. Vandermosten took part in the discussion following. Messrs. B. P. L'Hommedieu and H. Weida of the India Rubber Company, New Brunswick, N. J., gave a practical demonstration of the making of hard-rubber battery jars, which included almost every step in the process.

Chicago Electric Club.—Judge J. M. Dickinson, formerly Secretary of War in President Taft's Cabinet, addressed the Chicago Electric Club Feb. 18 on the subject of "Armament and Disarmament," pointing out in detail the deficiencies in the number of the army, the national militia, the coast defense works, and in means of furnishing supplies to a volunteer army of defense. Judge Dickinson's utterances before the Electric Club received wide circulation in the daily press. President Pinckard appointed Messrs. P. B. Woodworth, F. P. Vose and H. Ehrlich members of a committee to co-operate with the Western Society of Engineers, Chicago, in offering the services of electrical engineers and others for instruction in the construction and operation of electrical mechanisms of war and defense, supplementing the Engineer Corps of the regular army.

National District Heating Association.—The 1915 convention of the National District Heating Association will be held at the Hotel Sherman, Chicago, June 1, 2 and 3. Among the papers already scheduled on the technical program are those by Mr. C. F. Oehlman, Denver, Col., on "The Commercial End of the Heating Business"; Mr. W. G. Carlton, New York City, on "A Typical Hot-Water-Heating Plant"; Mr. C. C. Wilcox, Jackson, Mich., on "A Pressure-Survey Study"; Mr. G. W. Martin, New York City, on "Exhaust Steam Versus Live Steam for Heating," and one, title unannounced, by Mr. E. F. Tweedy, of the New York Edison Company. Reports will be submitted by the association committees on meters, rates, underground construction, education, station operation, station records and public policy. Mr. H. R. Wetherell, Peoria, Ill., is president of the National District Heating Association, and Mr. D. L. Gaskill, president of the Greenville (Ohio) Electric Light & Power Company, is secretary.

Public Service Commission News

California Commission

The commission has issued an order calling for an investigation, on its own initiative, into the rates charged by the United Light & Power Company for electrical energy supplied to the San Francisco, Oakland & San José Consolidated Railway Company and San Francisco-Oakland Terminal Railways. It appears that the interests in control of the railway company are also in control of the power company, and the evidence thus far secured seems to show, the commission says, that the contract imposes an onerous burden upon the railway company, with undue benefits to the power company.

Idaho Commission

The commission has refused to grant the application of the Great Shoshone & Twin Falls Water Power Company for a rehearing on the certificate of convenience and necessity granted to the Idaho Power & Light Company in the Twin Falls field. Attorney Hays of the Twin Falls company states that steps will be taken at once to take the matter into the State Supreme Court.

Claiming that Commissioner John W. Graham is unable to judge the question properly, the Great Shoshone Power & Light Company filed the petition for a rehearing of the recent order of the utilities commission permitting the Idaho Power & Light Company to enter the Twin Falls power field. Accompanying the petition was an affidavit by Mr. S. H. Hays, in which Mr. Graham was accused of having destroyed a letter from himself to the commission in February, 1914, which was said to show prejudice in favor of the Idaho Power & Light Company on the part of Mr. Graham. An interview given to a daily newspaper by Mr. Graham when he assumed office was also cited to show that the latter was unable to judge the case properly.

According to the affidavit of Mr. Hays, Mr. Graham was said to have written the commission on Feb. 4, 1914, from Twin Falls, urging that the Idaho Power & Light Company be allowed to enter the field. It was claimed by Mr. Hays that this alleged letter was written at the suggestion of the agents and representatives of the Idaho Power & Light Company.

New York Commissions

At the continued hearings before the legislative investigating committee in New York during the last week the principal witness has been Mr. Milo R. Maltbie, member of the First District commission. Through questions Col. William Hayward, counsel to the committee, brought out the statement that Commissioners McCall, Williams and Wood had often held secret conferences on transit matters without consulting Commissioner Maltbie. When Mr. Maltbie was asked how he discovered these secret meetings he testified that he happened to go into the chairman's room on several occasions and found the commissioners discussing details of construction and talking about applications from either the Brooklyn Rapid Transit or Interborough Rapid Transit companies for modifications of contracts. He said that he was invited to attend one such conference and from the discussion he believed that the other commissioners had talked over the matter before.

"The trouble with these secret conferences," Mr. Maltbie added, "was that many times I did not know what action had been taken on matters until they appeared on the regular calendar. Then I was put in the position of voting on matters without having any real light on the subject or of being recorded 'present but not voting.'"

Mr. Maltbie said that he thought that informal complaints should have been handled more promptly and efficiently than they had been, and if he had known that the conditions which Colonel Hayward had shown existed he would have taken the matter up. At one hearing which he conducted Mr. Maltbie learned that it had been the custom of inspectors of the commission to inform officials of transit companies of the results of their inspections of service. He immediately put a stop to this practice.

The witness was asked about complaints regarding New York Edison Company rates, and why it had taken so long to get a decision. Mr. Maltbie replied: "I think that

you do not give sufficient weight to the tremendous importance of this case. This is the biggest electric-light case in the United States. The questions involved are not only of rates but of discriminations." Mr. Maltbie said that he had finished his last opinion in the case within a day or two. He was willing, he said, to defend his procedure until the fall of last year, when the case was put into the hands of the full commission, but he would not be responsible for what had happened since that time.

Since differences had arisen between Commissioner Maltbie and the other commissioners cases involving capitalization, which he had handled previously, had been assigned to Commissioner Williams by Chairman McCall. Mr. Maltbie said that several months ago Chairman McCall began to assign capitalization cases to Commissioner Williams. Commissioner Eustis, he said, told him that Commissioner Williams had explained this by saying that the commission was anxious to get away from the precedents established by Mr. Maltbie. Answering a question as to what these precedents were, Mr. Maltbie replied: "That there be a dollar's worth of property for every dollar of security issued."

Commissioner Maltbie added that he had laid down hard and fast rules concerning capitalization. One was that no allowance should be made for any expenditures which had not been first checked by the engineers of the commission. Another was that bonds should not be approved unless there was a strong probability that the interest on them could be earned. In all but one of the capitalization cases in which decisions were prepared by Commissioner Williams Mr. Maltbie filed dissenting opinions. When the Consolidated Gas Company received authority to issue $25,000,000 convertible debentures to stockholders at par, Mr. Maltbie contended that if the company wanted to raise $25,000,000 it was not necessary, when the securities were selling well above par in the market, to issue more than, say, $23,000,000 to meet the needs.

Mr. Hayward put in evidence that in the last six months of 1914 the commission held 220 hearings, of which Mr. Maltbie conducted 115, Mr. McCall two, Mr. Williams forty-two, Mr. Cram twenty-nine, and Mr. Wood thirty-two. During the entire year 1914 forty-nine opinions were written. Mr. Maltbie wrote twenty-eight, Mr. McCall two, Mr. Williams six, Mr. Cram four, Mr. Wood two, and Mr. Eustis seven.

In discussing the suggestion that the supervision of construction work be taken away from the commission, Commissioner Maltbie said that a new board to be appointed by the Mayor might take over all rapid-transit work, and that it would not be much of an additional financial burden on the city if the engineers and other bureaus engaged in work of this kind were transferred to such a board from the Public Service Commission.

The Second District commission has discharged its order to show cause, directed against the Riddell Electric Light Company, why the commission's counsel should not proceed against it for occupying the streets and roads of the town of Hadley and furnishing electrical energy without a franchise approved by the commission. The order was taken on the complaint of the Town Board of Hadley. The Riddell company operates lawfully in the town of Luzerne, Warren County, across the Hudson River from Hadley, and M. B. and F. J. Riddell, who own the stock of the company, also operate a grist mill and telephone line in Hadley.

The town of Hadley operates a municipal electric plant, and the proof shows that the Riddells have been anxious to secure energy for their mill cheaper than the municipal plant would furnish it. The town superintendent refused a franchise for lines from their electric plant to their mill. The Riddells then had the electric company string wires on the telephone poles they owned to the residence of E. J. Riddell, in Hadley, near the mill, and for some time operated an electric lamp on the porch of the house, which they claimed was for testing purposes.

The order of the commission expresses the opinion that the "test" was of the disposition of the authorities of Hadley. The lamp in question has now been cut off, and the Riddells disclaim any intention of furnishing energy to themselves or any others in Hadley without first securing proper permission. The complaint has therefore been closed.

Personal

Mr. C. W. Colvin has been appointed transmission engineer of the British Columbia Electric Railway Company, Vancouver, B. C.

Mr. C. W. Whitley, one of the best known financiers in the West, has been elected president of the Utah Light & Traction Company of Salt Lake City, Utah.

Mr. H. L. Beach, at one time connected with the B. J. Arnold organization of Chicago as a traction expert, has been appointed manager of the Utah Light & Traction Company of Salt Lake City, Utah.

Mr. Wills Maclachlan has resigned his position with the Electric Power Company of Toronto, Ont., and is now inspector for the Electrical Employers' Association of Ontario, with headquarters at Toronto.

Mr. Joseph S. Wells, formerly manager of the Utah Light & Railway Company of Salt Lake City, Utah, has been appointed secretary-treasurer of the Utah Light & Traction Company, which has taken over the property.

Mr. David Daly, manager of the Houston Electric Company, Houston, Tex., has been appointed second vice-president of the Southwestern Electrical and Gas Association, succeeding Mr. C. W. Kellogg, Jr., who recently left the Southwest to become manager of the Mississippi River Power Company at Keokuk, Ia.

Mr. H. M. Byllesby was the guest of honor at a dinner given by the employees of H. M. Byllesby & Company, Chicago, Feb. 16, to mark Mr. Byllesby's fifty-sixth birthday. Mr. M. A. Morrison acted as toastmaster, and among the speakers were Messrs. J. J. O'Brien, R. J. Graf, E. C. Braun, R G. Hunt, W. R. Thompson, H. W. Fuller, W. H. Hodge, B. W. Lynch, W. H. Clarke, F. H. Lane and W. C. McKenna.

Mr. A. C. Jewett, chief engineer of the Kabul (Afghanistan) hydroelectric power transmission system, has returned to America on a four-month extraordinary leave granted him by His Majesty the Amir to enable him to visit the Panama Exposition. Mr. Jewett, who was formerly with the General Electric Company, has been abroad for the past fifteen years on hydroelectric transmission work in Brazil, India and Kashmir and for the last four years in Afghanistan in the employ of the Amir. Mr. Jewett will spend a month with his relatives in Fresno, Cal., and will return to Afghanistan on or about April 1, 1915.

Mr. Willard Wainwright Low, president of the Electric Appliance Company of Chicago and prominent in the Electrical Supply Jobbers' Association, was born at Flint, Mich., Oct. 24, 1858, and received his early education in the public schools of his native city. Mr. Low first entered the electrical business in 1884, when he went to Detroit and there associated himself with the Detroit Electrical Works. Three years later he removed to Chicago. In that growing Western city he joined the staff of the Central Electric Company, with which he was connected until 1891. In that year, with Mr. Thomas I. Stacey, Mr. Low severed his connection with the Central Electric Company and, together with Mr. Stacey, organized the Electric Appliance Company, of which Mr. Low has since been the president. Engaging in the electrical supply business, this company has enjoyed a prosperous growth under the broad-gaged administration of Mr. Low and his associates and now ranks with the largest jobbers of electrical supplies in the United States. Besides the main offices and stockrooms at 701 West Jackson Boulevard, Chicago, branch sales offices and stocks are maintained at San Francisco, Cal., Dallas, Tex., and New Orleans, La. "Billy" Low, as he is known by his large circle of friends in the electrical industry, is a Jovian, having joined the order early in its

WILLARD W. LOW

organization. As a business man Mr. Low has courageously and successfully applied the broadest and most approved principles of merchandising on a large scale, and he has always been active as a builder and co-operator for the best interests of the electrical industry.

Obituary

H. Ward Leonard, of New York, well known as an electrical engineer and inventor, and founder of the Ward Leonard Electric Company, died suddenly during the banquet of the American Institute of Electrical Engineers at the Hotel Astor, New York, on Feb. 18. Charming in manner and of commanding appearance, Mr. Leonard was one of the big men in the electrical industry of this country. He had patented more than 100 inventions, which are now important in commercial life. Among the more important are those relating to electrically driven reversible rolling mills, electric mine hoists, locomotives, elevators, gasoline-electric trucks, transmission gearing for motor cars, rheostats, automatic switches, electric heaters, automatic electric lighting systems for railway trains and motor cars, electric distributing systems and boosters. When he was twenty-three years of age he became associated with Thomas A. Edison as a member of Mr. Edison's staff of four engineers selected to introduce the Edison central-station system. A year before that he was graduated from the Massachusetts Institute of Technology. At the age of twenty-six he was made the general superintendent of the Western Electric Light Company at Chicago. The following year he formed the firm of Leonard & Izard, which made many important installations of central stations and electric railways. In 1889 the firm was bought out by the Edison interests and Mr. Leonard became general manager of the combined Edison interests for the United States and Canada, with headquarters in New York. In 1891 he completed his inventions of the Ward Leonard system of motor control, and in 1892 he gave the world his multiple-voltage system. The value of the Ward Leonard system of control was demonstrated in battle during the Spanish-American war, where it was used on one turret of the U. S. S. *Brooklyn*. After the war it was generally adopted by the United States Navy, and all of the ships are now equipped with it with a few unimportant exceptions. His system of "regenerative braking" has been extensively applied to mine hoists and is likely to be an important factor in future railroad operations. Another of Mr. Leonard's important inventions is the double-arm circuit-breaker which has come into almost universal use. Other important inventions are his lighting system for trains and automobiles and his form of change gear, which is now used in high-grade motor cars. His system of motor control was applied to the moving sidewalk at the Paris Exposition of 1900 after many ineffectual attempts to operate it by other systems, and was a feature of that exposition. For electrical-research work the Franklin Institute of Philadelphia in 1903 conferred upon Mr. Leonard the John Scott Medal. He was also awarded a gold medal at the Paris Exposition in 1900 and also a gold medal at the St. Louis Exposition in 1904. Mr. Leonard was a frequent contributor to scientific societies and to the technical press. He was a life member and fellow of the A. I. E. E. and served that body as vice-president, manager and as a member of the Edison Medal committee. He was also a member of the Inventors' Guild and of the New York Electrical Society and numerous New York social clubs. Mr. Leonard was born in Cincinnati, Ohio, Feb. 8, 1861, the descendant of a long line of American ancestors. A widow and a sister survive him.

H. WARD LEONARD

Corporate and Financial

Harwood Electric Dividends Deferred.—The Harwood Electric Company of Hazleton, Pa., has decided not to pay any further dividends on preferred stock for the present.

Utah Power & Light Bonds.—Harris, Forbes & Company, of New York, are offering at 92 and interest first mortgage 5 per cent gold bonds of the Utah Power & Light Company, due on Feb. 1, 1944.

Mexican Northern Power Bonds.—A meeting of bondholders of the Mexican Northern Power Company has been called for March 30 to authorize the issue of the remaining $2,000,000 of the 6 per cent thirty-year bonds authorized in 1914.

Montana Power Bond Offering.—Lee, Higginson & Company, the Guaranty Trust Company and J. & W. Seligman & Company of New York, are offering $10,000,000 first and refunding mortgage 5 per cent sinking-fund gold bonds of the Montana Power Company, due on July 1, 1943.

Short Stories of Public Utilities.—William, Dunbar & Coleman, of New York have issued the second number of their short stories of public utilities. The pamphlet, besides containing a brief reference to the development of gas and electricity, contains statistics regarding a number of public utility corporations.

Minneapolis General Electric Operations.—During 1914 the Minneapolis General Electric Company, a subsidiary of the Northern States Power Company, acquired 5509 new customers and 16,000 hp additional connected load. The electrical output of the Minneapolis Company and the Consumers' Power Company of Minnesota increased from 57,124,596 kw-hr. in 1911 to 110,346,450 kw-hr. in 1914.

Cumberland Edison Company to Issue Stock.—The Maryland Public Service Commission has authorized the Edison Electric Illuminating Company of Cumberland to issue stock certificates for $175,000 expended for improvements. While the company, which is capitalized at $200,000, claimed to have put into the plant $325,000 from income, the commission authorized an amount equal to what it regarded as the value of the plant over and above the outstanding capital. The stock will be distributed among the stockholders.

Electric Bond & Share Authorizes Increased Capital.—Immediately following the annual meeting of the Electric Bond & Share Company the directors authorized an increase in the capital stock of $3,000,000 common stock and $3,000,000 preferred stock. A portion of the preferred stock will be offered to preferred stockholders from time to time at par, and at such times the General Electric Company will purchase at par an equal amount of common stock. Messrs. Benjamin Strong, Jr., and R. T. Paine resigned as directors, and Messrs. G. E. Claflin and William Darbee were elected.

Buffalo General Electric to Issue Bonds.—The Buffalo (N. Y.) General Electric Company has been authorized by the Public Service Commission, Second District, to sell, at not less than 95, $900,000 of 5 per cent thirty-year first refunding mortgage bonds. The proceeds are to be used to reimburse the treasury for expenditures for the acquisition of the property, construction, completion, extensions and improvements of plant or distributing system, and the improvement of the service during the five years preceding Dec. 31, 1913, and properly chargeable to capital expenditure.

Pennsylvania Water & Power Sells Bonds.—The Pennsylvania Water & Power Company has sold $362,000 treasury bonds. This makes the bonded debt $10,485,000. All of the company's bonds are now outstanding, less those redeemed by the trustees or canceled for sinking-fund investment. In 1914 $58,000 was devoted to this purpose and $50,000 is provided for 1915. There is also a sinking-fund reserve of $200,000. During the year ended Dec. 31 $850,000 bonds were issued for construction work, all of which and $185,000 additional, which remained in the treasury from the preceding year, were sold.

Carolina Power & Light Annual Report.—The following figures were given for the electrical department of the Carolina Power & Light Company in its annual report for the year ended Dec. 31, 1914: Electric customers, 5235; output, 24,818,782 kw-hr.; miles of electric distributing lines

in service, 144; miles of high-voltage transmission lines in operation, 218. The statement, given herewith, includes income from all properties excepting the Asheville Power & Light Company and the Yadkin River Power Company:

	1914	1913
Gross income	$618,689	$525,213
Operating expenses and taxes	412,834	334,558
Net income	$205,855	$190,655
Other income	52,500	50,000
Total income	$258,355	$240,655
Interest on bonds	115,958	92,453
Sundry interest and discount	43,035	43,183
Balance	$99,362	$105,019

Laclede Gas Light Annual Report.—The annual report of the Laclede Gas Light Company, of St. Louis, Mo., states that the output of electrical energy increased 12.1 per cent during 1914. The income account follows:

	1914	1913
Gross earnings	$4,629,689	$4,533,492
Operating expenses, including maintenance and taxes	2,245,592	2,207,238
Depreciation	278,520	272,249
Net earnings	$2,105,577	$2,054,005
Interest	1,103,129	1,055,405
Preferred dividends	125,000	125,000
Common dividends	749,000	749,000
Total deductions	$1,977,129	$1,929,405
Balance, surplus	128,448	124,600

Interstate Electric Annual Report.—The annual report of the Interstate Electric Corporation of New York shows that the corporation during the year has acquired and canceled $181,200 bonds of subsidiaries. The consolidated statement of the company and its subsidiaries follows:

Year Ended Nov. 30	1914	1913
Gross earnings	$334,016	$306,803
Operating expenses	198,685	176,380
Net earnings	$135,331	$130,423
Interest on subsidiary bonds not owned	46,937	
Final net earnings	$88,394	
Interstate Electric Corporation interest	41,850	
Surplus	$46,544	

Federal Light & Traction Earnings.—The Federal Light & Traction Company's earnings statement for the year ended Dec. 31, 1914, is as follows:

	1914	1913
Gross earnings	$2,416,960	$2,372,174
Operating expenses and taxes	1,498,684	1,443,234
Net earnings (subsidiary companies)	$918,276	$928,940
Federal Light & Traction Company	29,623	36,640
Total income	$888,653	$892,300
Interest charges	586,155	531,787
Central Arkansas Railway & Light Corporation dividend	84,000	63,000
Federal Light & Traction Company dividend	112,500	150,000
Net income less interest charges and dividends	$105,998	$147,513

Commonwealth Edison Annual Report.—The directors of the Commonwealth Edison Company, Chicago, have submitted their annual report for the year ended Dec. 31, 1914. The income and expenses for the year were as follows:

Operating revenue		$19,060,196
Operating expenses	$9,793,493	
Appropriated for amortization and depreciation reserve	2,215,147	12,008,640
Net operating revenue		$7,051,556
Taxes and municipal compensation		1,492,266
Operating income		$5,559,290
Other income		217,763
Total income		$5,777,053
Less interest on bonds		1,600,000
Available for dividends		$4,177,053
Dividends paid		3,534,652
Balance carried to surplus		$642,401

United Gas & Electric Financing.—To redeem $7,500,000 of three-year 5 per cent gold-secured coupon notes maturing on April 1, 1915, the United Gas & Electric Company, of New York, has sold to Drexel & Company, of Philadelphia, $5,500,000 three-year 6 per cent gold-secured notes, and to Bertron, Griscom & Company, of New York, and Reilly-Brock & Company, of Philadelphia, $2,350,000 of thirty-year 6 per cent collateral trust bonds. The new notes are secured by $7,650,000 of the thirty-year collateral trust bonds. Of the new notes $500,000 are due on July 1, 1916, and $500,000 each six months thereafter, until $2,000,000 have been paid, leaving $3,500,000 to mature April 1, 1918.

Milwaukee Electric Railway & Light Annual Report.—The annual report of the Milwaukee (Wis.) Electric Railway & Light Company for the year ended Dec. 31, 1914, shows a decrease in operating revenues of $11,421 compared with the previous year. This decrease was caused by a reduction in revenues of the railway department of $110,593, which was offset in large part by an increase of $99,172 in the light and power department. Gross income of the light and power department from all sources increased from $786,722 to $892,249. The following is a comparative income account:

	1914	1913
Operating revenues	$6,005,495	$6,016,916
Operating expenses (total)	4,232,424	4,206,435
Current ordinary operating expenses	3,095,605	3,167,365
Depreciation	698,516	633,359
Contingencies	1,602	15,042
Taxes	436,701	390,669
Net operating revenues	1,773,071	1,810,481
Non-operating revenues	65,806	45,178
Gross income	1,838,877	1,855,659
Interest charges	823,374	733,322
Net income	1,015,503	1,122,337
Dividends on preferred stock	270,000	270,000
Dividends on common stock	763,375	788,000
Surplus	17,872	64,337

Pennsylvania Water & Power Annual Report.—The annual report of the Pennsylvania Water & Power Company for the year ended Dec. 31, 1914, states that the company went on a strictly operating basis Jan. 1, 1915, free from all its construction forces which have been maintained during the past five years, and that no further capital expenditures will be required during 1915. It is not now thought that further improvements will be needed before 1917. The profit and loss account for the year follows:

Gross earnings		$1,009,373
Operating expense	$62,703	
General expense	51,686	
Maintenance	39,432	
		153,821
Balance		$855,552
Interest on first mortgage bonds		443,574
Net revenue		$411,978
Balance from 1913		18,532
Total		$430,510
Dividends		339,800
Transferred to contingent fund		90,000
Profit and loss		$710

Kings County Electric Light & Power Annual Report.—The annual report of the Kings County Electric Light & Power Company for the year ended Dec. 31, 1914, showed that the business depression materially retarded the exceptional rate of growth enjoyed by the company during the first part of the year. During the year over seventy private plants were replaced by the company's service, four of them having over 1000 hp each. The total of connections in 50-watt equivalents was 3,276,475 on Dec. 31, 1914, as against 2,861,217 in 1913. The resultant increase in energy output was 10,468,162 kw-hr. The company's output in 1914 was 150,203,072 kw-hr. No new securities were issued during the year, but $365,200 of the first issues of $4,000,000 6 per cent twelve-year convertible debenture bonds dated March 1, 1910, were converted into stock. Since March 1, 1913, the date the bonds became convertible, $3,308,100 have been exchanged for stock. The financial statement follows:

	1914	1913
Total revenues	$6,346,466	$5,742,548
Expenses, including taxes and depreciation charges	4,197,430	3,662,628
Gross income	$2,149,036	$2,079,920
Bond interest and other income deductions	864,455	877,095
Dividends, profit sharing, etc	1,131,045	1,042,126
Surplus for the year	$153,536	$160,699

Salt Lake City Situation.—Stockholders of the Utah Securities Corporation of New York have been advised by President S. Z. Mitchell that the utility properties in Salt Lake City and Ogden, Utah, formerly controlled by the Oregon Short Line Railroad and now owned by the Utah Light & Traction Company are now controlled by the Utah Power & Light Company, a subsidiary of the Utah Securities

Corporation, through the ownership by it of all except directors' shares of the stock of the Utah Light & Traction Company. In addition to owning all of the stock of the Utah Light & Traction Company, the Utah Power & Light Company has leased for ninety-nine years from Jan. 1, 1915, the electric light and power and gas properties of that company. The electric railway property of the Utah Light & Traction Company in Salt Lake City and vicinity will continue to be operated directly by it and the surplus earnings will accrue to the Utah Power & Light Company through the ownership of stock. It is expected that the consolidation will effect material economies in the operation of the properties.

United Light & Power Reorganization Plan.—The United Light & Power Company of California has requested the Railroad Commission to approve a plan of reorganization providing for the transfer of all properties, the Equitable Light & Power Company, Consumers' Light & Power Company, South Side Light & Power Company, Central Oakland Light & Power Company and United Light & Power Company of New Jersey, through Mr. E. W. Wilson, of San Francisco, to a new company to be known as the Consolidated Electric Company. The new company shall issue $3,000,000 of 5 per cent forty-year gold bonds to be guaranteed, principal and interest, by the Great Western Power Company It is proposed to issue $2,207,000 bonds to be delivered to Mr. E. W. Wilson in payment for the property; $243,000 to be issued from time to time in exchange for a like amount of Consumers' Light & Power Company and Central Oakland Light & Power Company bonds; $71,000 to be issued to the Great Western Power Company in consideration of the guarantee of the bonds and for the performance of the contract between the Consolidated Electric Company and the San Francisco-Oakland Terminal Railway, and $72,000 for rehabilitation. The Great Western Power Company agrees to purchase $400,000 bonds delivered to Mr. E. W. Wilson on the following terms: $100,000 upon the transfer of the properties, $100,000 twelve months thereafter, $100,000 two years thereafter, and the balance of $100,000 three years thereafter. The Consolidated Electric Company proposes to issue all of its capital stock to the Great Western Power Company.

Washington Water Power Annual Report.—The annual report of the Washington Water Power Company for the year ended Dec. 31, 1914, showed the accompanying earnings statement. The maximum station load during 1914 was 39,718 hp, or a decrease of 1.7 per cent from 1913. The number of accounts increased 29 per cent, or from 22,640 in 1913 to 29,119 in 1914. The 1914 figures included accounts in towns in which the service was acquired recently. The total output was 169,691,800 kw-hr., an increase of 3.8 per cent over 1913. The Long Lake power station, begun in the fall of 1910, is now practically ready to supply energy. The construction work contemplated for 1915 for the electric light and power system is very much less than heretofore. It will consist principally of a few remaining items to complete the first two units at Long Lake and sundry items for extensions of lines and mains which will be done only when business is definitely in sight. During 1914 the expenditure for extensions and betterments in the light and power department of the company amounted to $1,967,260.

Gross operating revenue		$2,970,920
Receipts from interest on current balances		5,505
Total revenue		$2,976,425
Operating expenses including taxes		1,362,597
		$1,613,828
Net operating earnings:		
Interest on bonds	$254,093	
Interest on notes	144,854	
Premium on $99,000 bonds bought for sinking fund	2,624	
Annual credit for discount on first refunding mortgage bonds	8,000	
Interest on consumers' deposits, etc.	2,175	
Written off for replacement reserve	325,000	
Uncollectible accounts, etc.	5,804	
		742,550
		$871,278
Interest at 5 per cent on work under construction		223,168
Balance		$1,094,446
Dividends paid		1,094,863
Taken from surplus in 1914		417
Surplus from 1913		1,119,105
Surplus, Dec. 31, 1914		1,118,688

Manufacturing and Industrial

The Arnold Electric Company, Racine, Wis., is the name of the concern formerly known as the Standard Electric Works.

The Erie Pump & Equipment Company, Erie, Pa., has appointed Mr. N. H. Brown, formerly with the Bury Compressor Company, as its sales engineer.

The Lo-Glow Incubator Company, 76 Greenwich Street, New York, is the name of the company formerly known as the Standard Electric Incubator Company.

Walker Brothers & Haviland, manufacturers' agents, 1533 Chestnut Street, Philadelphia, Pa., have appointed on their staff Mr. F. P. Groves, formerly with the Sprague Electric Works of the General Electric Company.

The Electrical Alloy Company, Morristown, N. J., has opened offices at 30 Church Street, New York, the Bourse, Philadelphia, and the Equitable Building, Baltimore, which will be in charge of Mr. E. O. Osters, who has been appointed Eastern representative of the company.

The Pelton Water Wheel Company, San Francisco, Cal., has appointed Mr. E. M. Breed, who for the past eight years has been district manager of Allis-Chalmers-Bullock, Ltd., with headquarters at Vancouver, district manager. Mr. Breed will continue to have his headquarters at Vancouver.

The Wagner Electric Manufacturing Company.—Mr. W. Thomas, treasurer of the Wagner Electric Manufacturing Company, St. Louis, Mo., has been elected a vice-president of the company. Mr. Walter Robbins, for many years assistant general manager of the above company, has also been elected a vice-president.

Order for Guy Anchors.—A large number of 8-in. guy anchors were recently ordered by the Pacific Telephone & Telegraph Company from W. N. Matthews & Brother, St. Louis, Mo., for use on a portion of its line which passes through Nevada. This line forms part of that connecting New York to San Francisco.

Mr. Arthur L. Mullergren, consulting engineer, has opened an office at Poteau, Okla. Mr. Mullergren will devote his attention particularly to public utility engineering, specializing in appraisals and investigations of such properties. Mr. Mullergren has severed his connections with the Mullergren Engineering Company of Poteau, Okla.

Mr. A. B. Wilson, for the past six years connected with the National Electric Light Association in the "tungstolier" and "holophane" departments, is now in business for himself with headquarters at 357 Leader-News Building, Cleveland, Ohio. Mr. Wilson will act as representative for various concerns and will be engaged in the marketing of electrical specialties.

Growing Demand for Electrically Operated Butter Churn.—The Taylor Brothers Churn & Manufacturing Company, St. Louis, Mo., is noting an ever-increasing demand from small towns and villages for its motor-driven butter churn. Both General Electric and Robbins & Myers motors are used to operate this machine. It is being exhibited at the exposition in San Diego by the Robbins & Myers Company and at the San Francisco Exposition by the General Electric Company.

Cole, Ives & Davidson, 61 Broadway, New York, is the name of a concern recently formed which will be engaged in investigations and reports for financial interests, making inventories and valuations of public-utility and industrial properties and design, installation and management of power plants. The firm is composed of Messrs. W. W. Cole, formerly of Day & Zimmerman of Philadelphia, A. S. Ives and R. A. Davidson, and will take over the business of the former firm of Ives & Davidson, of 84 William Street.

Walpole Tire & Rubber Company.—For the purpose of complying with an order of the court the property of the Walpole Tire & Rubber Company, Walpole, Mass., will be placed on sale at Walpole on March 10, 1915. It is expected that after the sale the business will be continued as before. This company was placed in the hands of receivers on Aug. 2, 1913, through the failure of the Atlantic National Bank of Providence, R. I., since which time the receivers have conducted the business for the stockholders and have shown a profit on each month's operation.

Mr. Antoine Bournonville, who has been connected with the business of the late Alfred F. Moore, manufacturer of insulated wire, 200 North Third Street, Philadelphia, Pa., has recently resigned.

W. N. Matthews & Brother, St. Louis, Mo., have opened a district office in Denver, Col., which will be under the charge of Mr. O. H. Davidson. Mr. Davidson's office will be in the Ideal Building, and he will be in charge of territory in Colorado, Utah, Wyoming, Montana, Idaho and western South Dakota. The above concern also has district offices in the Hudson Terminal Building, New York, under the management of Mr. W. M. Heim; 507 South Clinton Street, Chicago, under the management of Mr. W. E. Bischoff, and 629 Howard Street, San Francisco, under the management of Mr. L. E. Sperry.

The Edward F. Caldwell Company, 36 West Fifteenth Street, New York, which was incorporated Oct. 25, 1914, is in the business of manufacturing gas-lighting and electric-lighting fixtures and ornamental-brass and wrought-iron devices. The officers of the company are as follows: Messrs. V. F. Von Lossberg, president, formerly a partner of the concern known as Edward F. Caldwell & Company; W. Klehr, vice-president, formerly with the Archer & Pancoast Company, the Sterling Bronze Company and Edward F. Caldwell & Company; E. T. Caldwell, treasurer, and L. Livingston, secretary, formerly with the Archer & Pancoast Company.

Brass-Shell Socket for Portable-Lamp Fixtures.—The 660-watt push-button, brass-shell socket made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is being utilized on portable-lamp units made by the Wallace Novelty Company, the Leindorf Electric Light Company, the Aladdin Lamp Corporation, the Dale Lighting Fixture Company and the H. G. McFadden Company. The indicating push-button socket, the manufacturers declare, has been found advantageous because of the compactness of the device. "Push the button" is the direction given for operating the socket as well as for taking up the slack in the portable cord for a number of the portable units with which it is used. Small electrolier sockets made by the Cutler-Hammer company are also employed on several styles of lamps manufactured by the above makers of portable units.

Orders for Stokers.—The Sanford Riley Stoker Company, Ltd., Worcester, Mass., has recently received the following orders: The Boston Elevated Railway Company, for its South Boston station, four seven-retort stokers for 600-hp Babcock & Wilcox boilers; the Millville Manufacturing Company, Millville, N. J., one seven-retort stoker for a 600-hp Edge Moor boiler; the International Railway Company, Buffalo, N. Y., two four-retort and two five-retort stokers for 265-hp and 400-hp Babcock & Wilcox boilers; the Carter White Lead Company, West Pullman, Ill., two five-retort stokers for 410-hp Geary boilers; the Hartford Electric Light Company, Hartford, Conn., two fourteen-retort stokers for 1250-hp Bigelow-Hornesby boilers; the Massachusetts Institute of Technology, Cambridge, Mass., three six-retort stokers and one three-retort stoker for 520-hp and 274-hp boilers; the Hood Rubber Company, Watertown, Mass., two five-retort stokers for 500-hp Edge Moor boilers.

Order for Submarine Cable.—The Simplex Wire & Cable Company, Boston, Mass., has been awarded the contract to manufacture and to lay about one mile of three-conductor, cambric-insulated submarine cable for the Rockingham County Light & Power Company of Portsmouth, N. H. The cable is to be laid across Great Bay, above Portsmouth, early in the spring and will form a part of the transmission line from the central station at Portsmouth, through the towns of Newington, Durham and Madbury, to Dover, where energy is supplied for the Dover, Somersworth & Rochester Street Railway Company. At Durham the branch line supplies energy for lamps and motors to the New Hampshire College. Each conductor is to be No. 4 B. & S. stranded copper and will be provided with varnished-cambric insulation 7/32 in. thick. A jacket of varnished cambric 6/32 in. thick will be applied over the three insulated conductors after they are twisted together. The cable is to be protected by a lead sheath ⅛ in. thick and an armor of No. 6 B. W. G. galvanized-steel wire, and it will weigh about 12 lb. per ft. It will be sent from Boston to Portsmouth on a lighter, the gross shipping weight being about 65,000 lb. The T. A. Scott Company of Boston, marine contractor and wrecker, will supply the lighter and apparatus to be used by the Simplex Wire & Cable Company on this work.

The National Lighting Products Company, Jenkins Arcade, Pittsburgh, Pa., which was recently formed, is in the business of manufacturing holders, brackets and posts for street and industrial lighting and also ornamental fixtures for commercial lighting such as of stores, office buildings, theaters, etc. This company was especially organized to promote street-lighting campaigns for central stations. This service is extended to central stations without cost and has proved successful, it is claimed, to the various companies in increasing their lighting loads. The officers of the company are: President, Mr. Frank C. Murdock, formerly secretary and sales manager of the Multi-Lux Illuminating Company, Cleveland, and prior to his connection with that company with the Westinghouse Lamp Company, Bloomfield, N. J.; vice-president, Mr. G. E. Lanz, who is also Pittsburgh district manager of the Packard Lamp Division, National Lamp Works of the General Electric Company, and who was formerly illuminating engineer for the Pacific Gas & Electric Company, San Francisco, Cal.; secretary, Mr. V. E. Truxell; treasurer, Mr. R. E. Gannon, formerly vice-president and sales maanger for the Freehold Lumber Company, Pittsburgh, Pa.

The Automatic Electric Company, Chicago, Ill., held a conference Feb. 5 and 6 at its factory, at which representatives of some eighteen telephone companies using automatic equipment representing approximately 300,000 subscribers were present. The conference was held under the auspices of the Ohio Automatic Telephone Association, comprising companies operating automatic exchanges in Akron, Bucyrus, Cambridge, Columbus, Dayton, Kenton, Newark, St. Mary's and Van Wert, in Ohio, and Richmond, in Indiana. The Automatic Electric Company is a member of the Ohio association and acts as host to the organization for one of these meetings each year, invitations being extended to various companies operating automatic equipment to be represented at the annual conventions. The morning of the first day of the convention was devoted to an inspection of the factory, and the rest of the time was given over to papers and discussions. Papers were read on standardized nomenclature by Mr. Roy Owens, on automatic rural line equipment by Mr. B. D. Willis, on transmission losses in various circuit combinations, both practical and theoretical, by Mr. A. B. Smith, on multi-office installation of automatic equipment and gradual change to full automatic equipment by Mr. B. D. Groh, on automatic equipment in foreign governmental exchanges by Mr. E. A. Mellinger, on long-distance automatic calling and switching of toll lines by Mr. John Wicks, and on automatic private-branch exchanges and private automatic switchboards by Mr. J. H. Finley, all of the Automatic Electric Company.

NEW YORK METAL MARKET PRICES

Copper	Feb. 16 Selling Prices Bid	Feb. 16 Selling Prices Asked	Feb. 28 Selling Prices Bid	Feb. 28 Selling Prices Asked
	£ s d		£ s d	
London, standard spot*	63 15 0		64 15 0	
Prime Lake	14.62½	to 14.87½	14.62½	to 14.87½
Electrolytic	14.55	to 14.65	14.55	to 14.65
Casting	14.10	to 14.20	14.10	to 14.20
Copper wire base	15.87½		15.87½	
Lead	3.85		3.85	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	12.00		12.00	
Spelter, spot	9.00	to 9.25†	.....	to 9.50†
Tin, straits	36.37½		39.00	
Aluminum, 98 to 99 per cent.	19.00	to 19.50	19.00	to 19.50

*OLD METALS

Heavy copper and wire	12.50	12.50
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	3.60	3.55
Zinc, scrap	5.37½	6.00

COPPER EXPORTS

Exports of copper in form of pigs, ingots, bars, plates and scrap for week ended Feb. 13, 1915 ..... 7,142,042 lb.

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Vinton Ice, Light & Water Company, of Vinton, La., has been incorporated with a capital stock of $20,000 to construct and operate an electric-light plant, water-works system and ice factory.

The Sevierville Light & Power Company, of Sevierville, Tenn., has been incorporated by Stanley McMahan and others. The company is capitalized at $6,000 and purposes to construct and operate a power plant and transmission lines. All material for the work, it is understood, has been purchased. Stanley Kennedy, of Sevierville, is engineer and contractor.

New Industrial Companies

The Electric Construction & Sales Company, of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 by Frederick Rex. Sigrid Latimer, Harry C. Turneck and others.

Moyer & Fairbault, of Brooklyn, N. Y., have been incorporated with a capital stock of $15,000 for the purpose of doing a general contracting, construction, electrical and mechanical engineering business.

The Jefferson Electrical Manufacturing Company, of Chicago, Ill., has been incorporated by A. R. Johnson, J. C. Daley and J. A. Bennan. The company is capitalized at $25,000 and proposes to manufacture electrical and mechanical supplies.

The Valleau-Quinn Corporation, of New York, N. Y., has been chartered with a capital stock of $25,000 to deal in fireproofing and insulating material. The incorporators are T. M. Valleau, of Brooklyn, N. Y.; A. M. Ehret, of Philadelphia, Pa., and J. W. Quinn, of New Rochelle, N. Y.

The Motion Display Corporation, of New York, N. Y., has been incorporated with a capital stock of $100,000 by I. B. Brown, E. I. Hendrick and G. R. Coughlan, of New York, N. Y. The company proposes to manufacture motors, engines, advertising devices, movable signs and display tables.

Trade Publications

Electric Horn Switch.—A folder describing a ring-type automobile-horn switch is being sent out by W. P. Seng, 1450 Dayton Street, Chicago, Ill.

Flashlamps.—The Beacon Miniature Electric Company, 118 Duane Street, New York, is sending out several folders describing its various types of flashlamps.

Cut-out Pulleys.—The George Cutter Company, South Bend, Ind., is sending out a leaflet which describes its cut-out pulleys for series or multiple circuits.

Guy Anchors.—The Electric Service Supply Company, Philadelphia, Pa., is sending out a folder containing information on its "Never-Creep" guy anchors.

Centrifugal Pumps.—The Goulds Manufacturing Company, Seneca Falls, N. Y., is sending out a folder containing information on its multi-stage motor-driven pumps.

Incandescent Lamps.—Various types of tungsten and carbon lamps are listed in a folder being sent out by Duhrssen & Pfaltz, Inc., 19 East Seventeenth Street, New York.

Comptometer.—A catalog entitled "Engineering Calculations," issued by the Felt & Parran Manufacturing Company, Chicago, Ill., contains information on its comptometer.

Vibrator.—The New Era Spring & Specialty Company, 870 Woodward Avenue, Detroit, Mich., is sending out a folder which describes its vibrator for ignition sets.

Interlocking Switch Plugs.—A card is being sent out by the Simplex Conduits, Ltd., London, Eng., directing attention to some of the features of a 5-amp interlocking switch plug.

Ornamental Lighting Standards.—"What Every City Needs" is the title of a folder being sent out by the Ornamental Lighting Pole Company, 17 Battery Place, New York.

Electric Tools.—The Stow Manufacturing Company has recently issued a catalog designated as No. 54, which contains information on several types of its electrically operated tools.

Electrical Instrument.—James D. Biddle, 1211 Arch Street, Philadelphia, Pa., is sending out a mailing card which contains information on Siemens & Halske electrical instruments.

Semi-Indirect-Lighting Units.—The Frank Adam Electric Company, St. Louis, Mo., has recently issued a catalog designated as No. 26, which contains information on semi-indirect-lighting fixtures.

Attachment Plugs.—Bulletin No. 15-8 issued by Harvey Hubbell, Inc., Bridgeport, Conn., contains information on signal attachment plugs and separable attachment plugs with a split-bushing strain relief.

Meter-Testing Plugs.—The Metropolitan Engineering Company, Forty-second Street Building, New York, is sending out a revised bulletin designated as Section No. 5, which dsecribes its meter-testing plugs.

Electric Fans.—A booklet designated as Form No. 1039 issued by the Robbins & Myers Company, Springfield, Ohio, lists the various types of alternating-current and direct-current fans made by the company.

Push-Button Socket.—"An Inquiry and the Answer" is the title of a folder published by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which contains information on a 660-watt push-button socket.

Vacuum Impregnating Process.—The Doubleday-Hill Electric Company, 719 Liberty Avenue, Pittsburgh, Pa., is sending out a folder which describes its vacuum process for impregnating coils with insulating compound.

Small Alternating-Current Motors.—Bulletin No. 201 issued by the Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., contains information on fractional-horse-power alternating-current motors for flashers.

Cut-Out Boxes.—"Service Cut-Out Box and Meter Adapter" is the title of a revised bulletin designated as Section 3 being sent out by the Metropolitan Engineering Company, Forty-second Street Building, New York.

Street-Lighting Units.—A catalog entitled "Second Reader," issued by the National Lamp Works of the General Electric Company, Cleveland, Ohio, contains information on incandescent lamps for street and store-front lighting.

Wooden Apparatus.—Catalog No. 115 issued by the American Wooden Ware Manufacturing Company, Toledo, Ohio, contains information on its hand-operated and electrically operated churns, washing machines and butter workers.

Electrical Devices.—The Electric Engineers' Equipment Company, Chicago, Ill., has issued a bulletin designated as No. 104, which describes and illustrates various types of busbar clamps, cable racks, floor air boxes, switchboard fittings, etc.

Indirect-Lighting and Semi-Indirect-Lighting Units.—Catalog No. 4 published by the Luminous Unit Company, St. Louis, Mo., contains a number of attractive illustrations of various types of semi-indirect-lighting and indirect-lighting fixtures.

Brake Lining.—The Standard Woven Fabric Company, Framingham, Mass., has issued a booklet entitled "Jim Jams and His Jababout," which contains a poem outlining the virtues of its product called "multibestos" for lining the brakes of automobiles.

Electric Apparatus.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is sending out the following new catalogs: Folder No. 4205-B, entitled "For Better Projection"; Folder No. 4152, entitled "The Westinghouse Sewing-Machine Motors"; Folder No. 4201, entitled "Automobile Battery Charging"; Folder No. 4266, entitled "How Electric Power Helps Manufacturers"; Folder No. 4266, entitled "The Electric Breakfast Set"; Dealers' Catalog No. 3001, entitled "Electric Fan"; Folder No. 22, entitled "Small Motors"; Descriptive Leaflet No. 7770, entitled "Electric Cam-Limit Switches"; Leaflet No. 3679, entitled "Electric Vehicle Battery-Charging Switchboard and Motor-Generator Set"; Descriptive Leaflet No. 3698, entitled "Motors for Linotype and Intertype Machines"; Leaflet No. 3751, entitled "Current-Limiting Reactance Coils."

Construction News

New England

NORTH ADAMS, MASS.—Preparations are being made by the Deerfield Pwr. Co. for extending the power transmission lines from the Zylonite power station in Adams to North Adams and Briggsville and from there to Bennington, Vt., by the way of Pownal and North Pownal, Vt. Poles will be erected as soon as the frost is out of the ground. The company will supply electricity to the Strong-Hewat Mill at Briggsville. W. S. Smith, of Winchenden, is engineer in charge.

SALEM, MASS.—Bids will be received at the City Hall, Salem, Mass., by the Salem and Beverly Water Supply Board until March 10 for the construction of additional works for water supply from the Ipswich River. The work will be divided into two parts. The first contract includes the construction of a dredge, 120,000 cu. yd. of excavation, 2870 ft. of conduit and accessories; the second contract covers an electric-motor-driven and centrifugal pump, a steam-driven generator, transmission line, transformers, switchboard and wiring. Plans may be seen and form of proposal, specifications, etc., may be obtained at the city hall, Salem, and at the office of Hazen, Whipple & Fuller, consulting engineers, 30 East Forty-second Street New York, N. Y.

SPRINGFIELD, MASS.—Bids will be received by the committee on city property, Springfield, until March 11 for furnishing and installing electric-lighting fixtures in the High School of Commerce. Specifications may be seen at the office of Kirkham & Parlett, architects, Carr Building, Springfield, Mass.

QUINEBAUG, CONN. — The Fabyan Woolen Co., of Quinebaug, it is reported, has awarded the contract for construction of a power house, 50 ft. by 80 ft., with a 125-ft. chimney to the Eastern Construction Co., of Woonsocket, R. I.

Middle Atlantic

ALBANY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 25 for remodeling an electric passenger elevator in the United States post office and custom house in Albany, N. Y. For details see proposal columns.

BROOKLYN, N. Y.—Bids will be received by L. H. Pounds, president of borough of Brooklyn, Borough Hall, Brooklyn, until March 3, for furnishing and delivering one automobile dump truck at municipal asphalt plant, Seventh Street Basin, Gowanus Canal, on or before April 15, 1915. Blank forms and further information may be obtained and plans and drawings may be seen at the office of Bureau of Highways, 50 Court Street, Brooklyn.

BROOKLYN, N. Y.—Bids will be received by L. H. Pounds, president of the borough of Brooklyn, Borough Hall, Brooklyn, until March 17, for the mechanical equipment of pumping station at Avenue U and Ocean Parkway Section 2, sanitary sewers and storm-water sewers in Avenue U from Ocean Parkway to Gravesend Avenue and force main in Avenue U from Ocean Parkway to East First Street, together with an intermediate pumping station and appurtenances at the intersection of Avenue U and Ocean Parkway. The work includes furnishing and installing two directly connected motor-driven, vertical-shaft-type 12-in. centrifugal sewage pumps, including driving motors, automatic electrical control apparatus, ventilating system, all switchboards, wiring and fixtures for lamps and motors, and all ladders, gratings, piping, valves and fittings in the dry well, etc. Blank forms and other information may be seen at the Bureau of Sewers, borough of Brooklyn, 215 Montague Street, Brooklyn.

BUFFALO, N. Y.—The proposition to install magnetite-arc lamps on Washington Street, from Chippewa Street to Exchange Street, has been approved by the City Council. The lamps are to be installed as soon as funds are available.

BUFFALO, N. Y.—Arrangements are being made for a meeting of trade organizations of the cities of western New York at Niagara Falls shortly to consider a plan to construct and operate a hydroelectric plant at Niagara Falls to supply them with electricity for lamps and motors. Frank C. Perkins, engineer, of Buffalo, is arranging the matter.

CICERO, N. Y.—The Public Service Commission has approved the transfer of the franchise for electric service from Fred Auburn to the North Syracuse Lt. & Pwr. Co. in the town of Cicero and Brewerton and along the line of the Syracuse, Watertown & St. Lawrence Railroad.

ELBA, N. Y.—The Elba Food Products Co., it is reported, is planning to construct a power house, one story, 52 ft. by 75 ft., in connection with its new canning and preserving factory.

LONG ISLAND CITY, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until March 8 for electric work in Public School 85, Debevoise Avenue near Woolsey Avenue, Long Island City. Blank forms, plans and specifications may be obtained or seen at the above office and also at branch office, 69 Broadway, borough of Queens.

NEW YORK, N. Y.—Bids will be received by the board of trustees of Bellevue and Allied Hospitals Department of New York City, 415 East Twenty-sixth Street, New York, until March 5 for providing all material and labor required for excavation, masonry, carpentry, steel and iron work, metal work and roofing, painting and glazing, hardware, electric work, refrigerating and drinking water and all other work for the alterations to the present main building of the Harlem Hospital, 136th and 137th Streets and Lenox Avenue, borough of Manhattan. Blank forms and further information may be obtained at the office of the contract clerk and auditor, 400 East Twenty-ninth Street.

PERRY, N. Y.—Plans are being considered by the Perry El. Lt. Co., of Perry, and the Warsaw Gas & El. Co., of Warsaw, to erect a transmission line between Perry and Warsaw, via Silver Springs, to connect the two plants. It is also proposed to supply electricity to farmers along the line. Later the company plans to build a central station and furnish electrical service to several small towns in this section. C. W. Torrey is manager.

BUTLER, PA.—The Butler Lt., Ht. & Pwr. Co. is installing new equipment in its power station, which will double the generating capacity of the plant. The present boilers will be replaced with three boilers of 250 hp each, and two new engines with a rating of 500 hp and 400 hp will be installed.

PHILADELPHIA, PA.—An agreement has been reached between the Philadelphia El. Co. and the Keystone Tel. Co. whereby the former has obtained a lease of the surplus space in the underground conduits of the telephone company for a period of 21 years.

CLINTON, N. J.—Bids will be received by the board of managers of the New Jersey State Reformatory for Women, Clinton, N. J., until March 5, for erection of electric transmission line. Plans and specifications are on file with the commissioner of charities and corrections, State House, Trenton, N. J.

WILMINGTON, DEL.—Bids will be received by the Street and Sewer Department, Wilmington, Del., until March 9 for lighting the streets of the city for a period of five years. The present contract expires April 1.

BALTIMORE, MD.—Plans are being considered for the installation of a turbine engine in the high-pressure power station on South Street, near Pratt Street, to cost about $15,000. Additional power is needed to supply electricity for lighting the city hall and court house; also for operating the elevators in the city hall.

HUNTINGTON, W. VA.—The installation of an ornamental street-lighting system in the business district is under consideration by the Board of Trade.

MARLINTON, W. VA.—Application will be made to the Pocahontas County Commissioners by A. E. Huddleston for permission to erect transmission lines from Seebert to the turnpike road between Hillsboro and Millpoint.

LEXINGTON, VA.—The Blue Ridge Pwr. Co. is reported to be contemplating the construction of a dam over the James River on the old dam site at Balcony Falls. The water-power will be used to generate electricity.

SOUTH BOSTON, VA.—The South Boston El. Lt. & Pwr. Co., it is reported, has decided to make improvements to its electric plant, involving an expenditure of about $10,000.

WASHINGTON, D. C.—Bids will be received by the general supply committee at its office in Washington, D. C., until March 10 for furnishing materials, supplies and equipment for use by the executive departments and independent government establishments in federal building service under the control of the Treasury Department, supervising architect's office, during the fiscal year beginning July 1, 1915, and ending June 30, 1916, as follows: Class 6—electrical engineering and plumbing supplies; class 15—incandescent electric lamps (special form A); class 16—incandescent gas-lamp supplies; class 17—motor trucks (special form A); class 19—electric service, and class 20—telephone service.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 15,646—The British Trade Commissioner for Australia reports that tenders are invited until March 10 by the Melbourne, Brunswick & Coburg Tramways Trust, Coburg, Victoria, Australia, for furnishing car equipment and air brakes for single-type trucks, single-truck combination car bodies, and wheel-guard equipment and operating gear. Copies of specifications, form of tenders, etc., may be obtained at the above office. No. 15,649—A business man in Russia requests an American consul to put him in communication with American firms with a view to purchasing electric and photographic supplies, etc. Correspondence should be in Russian or French. No. 15,650—A Russian merchant in the Far East has informed an American consular officer that he desires to receive catalogs, price lists, export discounts, etc., of electrical supplies and machinery of all kinds. No. 15,654—A firm in Denmark has requested an American consular officer to put it in touch with American firms which are in a position to supply electric-lighting fixtures and fixtures suitable for gas and acetylene lighting. Correspondence may be in English. No 15,627—A manufacturers' agent in Australia has informed an American consular officer that he wishes to get into communication with American firms handling or manufacturing tolls and magnetos. It is stated that the agent wishes to submit bids for government business. No. 15,662—A business man in the United States has written the Bureau of Foreign and Domestic Commerce that a friend in the Near East wishes to get in touch with manufacturers of electrical and hydraulic power plants, flour-milling machinery, gasoline boats and gasoline engines. No. 15,677—The Bureau of Foreign and Domestic Commerce is in receipt of a letter from an agent in Spain who desires to represent American manufacturers of and dealers in copper, iron and steel wire, copper, iron and steel bars and sheets, etc. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

North Central

BAY CITY, MICH.—The North American Chemical Co., of Bay City, has placed an order with the Westinghouse El. & Mfg. Co., of Philadelphia, Pa., for electrical equipment to replace the machinery now in use in the manufacture of chemicals.

DETROIT, MICH.—The Ford Motor Co., of Detroit, is installing four additional direct-current generators, 3800 kw each, in its Detroit plant. At the Walkerville (Ont.) plant a 900-kva Crocker-Wheeler alternating-current generator is being installed.

EATON RAPIDS, MICH.—The city of Eaton Rapids expects to install before next fall a 120-kva generator in the municipal electric-lighting plant. I. R. Ellison is superintendent.

ENGADINE, MICH.—The Edwin C. Bell Co., of Engadine, is contemplating installing an electric plant in its factory and proposes to install equipment with sufficient output to supply electricity for lighting the streets and residences of the village.

HOWARD CITY, MICH.—The City Council has awarded the Howard City El. Lt. & Pwr. Co. a new contract for street-lighting for a period of eight years, under the terms of which the present arc lamps are to be replaced with 30 150-watt tungsten lamps, work on which will begin as soon as the weather will permit. Equipment for the proposed change has been purchased. G. W. Greene is owner and manager.

PORTAGE, MICH.—The Township Board has decided to submit to the voters the proposal to issue $100,000 in bonds for the construction of a municipal electric-light plant, either at the April election or later at a special election.

SAGINAW, MICH.—The proposal to issue $500,000 in bonds for establishing a municipal electric-lighting plant in Saginaw was defeated at an election held Feb. 17.

BOWLING GREEN, OHIO.—The Board of Trustees of the Bowling Green State Normal School has awarded the contract for the construction of the power house to Fitzpatrick & Haffner, of Columbus, for $45,881.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until March 9, for a 3-ton motor truck for the Bridge Department. Specifications and bidding blanks may be obtained at the office of the commissioner of engineering, Room 405, City Hall. A. R. Callow is commissioner of purchases and supplies.

FREMONT, OHIO.—Bids will be received by the director of public service of the city of Fremont until March 4 for lighting the streets and public places with tungsten electric lamps from March 1, 1915, to June 22, 1922, according to plans and specifications on file in the office of the director of public service.

IRONTON, OHIO.—The new plant of the Marting Iron & Steel Co. will be equipped for electrical operation. Energy for operating the plant will be furnished by the Ohio Valley El. Co. Equipment for the plant, it is understood, has been purchased.

NEWARK, OHIO.—The Newark Furniture Co. has contracted with the Ohio Lt. & Pwr. Co., of Newark, for electricity to operate its plant. The company proposes to discard its steam plant.

NEW BERLIN, OHIO.—Bids will be received by the Village Council until March 4 for lighting the streets and the public places in New Berlin with electricity or gas. The estimates provide for 40 or more electric lamps of 100 cp and one lamp of 400 cp. Clyde R. Powell is clerk.

RIPLEY, OHIO.—Bonds to the amount of $12,000 have been sold, the proceeds of which will be used for the construction of a municipal electric-lighting plant in Ripley.

ST. PARIS, OHIO.—The village of St. Paris is contemplating extending the cluster-lamp street-lighting system this summer. J. C. Phelps is superintendent.

STEUBENVILLE, OHIO.—The Steubenville & East Liverpool Ry. & Lt. Co., of Steubenville, is erecting an outdoor-type substation, equipped with 3000 kw in transformers, to receive energy from the plant of the American Gas & El. Co., of Wheeling, W. Va. B. J. Jones is manager.

YOUNGSTOWN, OHIO.—The city of Youngstown has awarded the contract for street-lighting to the Youngstown & Sharon St. Ry. Co. for a period of 10 years. The contract calls for approximately 3200 bracket lamps of 100 cp and 316 1000-cp and 600-cp lamps, to be placed on ornamental standards. Work will begin at once on the system. H. Whitford Jones & Co., of Cleveland, will supervise its installation.

FALMOUTH, KY.—Bids are being received by the city of Falmouth on $3,000 in bonds, the proceeds of which are to be used for improvements to the municipal electric-lighting plant and water-works system.

SMITH'S GROVE, KY.—The Town Board has awarded the contract for the construction of an electric-light plant in Smith's Grove to Gill Edwards, of Pembroke, Ky.

ANGOLA, IND.—The Indiana Utilities Co., of Angola, has recently rebuilt its 13,200-volt transmission line and installed new pumps. The company has purchased material for an ornamental lighting system and for street series (tungsten lamps) lighting system for Waterloo, Ind.; not yet installed. E. J. Condon is general manager.

CHALMERS, IND.—At a mass meeting held recently favorable action was taken on the proposal to establish a municipal electric-lighting plant in Chalmers. It is proposed to secure energy from the Fort Wayne & Northern Indiana Trac. Co. The present plans provide for the erection of a transmission line from Battle Ground to Chalmers and the installation of a distributing system by the municipality of Chalmers.

HUNTINGTON, IND.—The city of Huntington is now erecting a new municipal power station, equipped with one 250-kw Westinghouse turbine, new boilers and piping throughout, three mercury-arc rectifiers, outfits of 100 lamps each; 200 magnetic-arc lamps are also being installed. Material has already been purchased. J. W. Hier is superintendent.

VINCENNES, IND.—R. S. Stangland, representing the City El. Ltg. Co., of Vincennes, it is reported, has agreed to the plan of the city officials to replace the present wooden poles and arc lamps on Main Street with iron standards and cluster lamps.

CHICAGO, ILL.—Bids will be received by William P. Huebner, secretary, Northwest Park District, 2742 North Avers Avenue, Chicago, until March 1, for installing an underground electric-lighting system in park bounded by Diversey, Avers, Schubert and Harding Avenues. Plans are on file at the office of the superintendent of board.

CUBA, ILL.—The Central Illinois Lt. Co., of Cuba, is changing its primary distribution system from 1100 volts to 2200 volts and will extend its transmission line to the property of the Star Coal Mine Co., a distance of ¼ mile, to supply electricity for motors. W. J. Turner is superintendent.

KINMUNDY, ILL.—Within the next ten months the Kinmundy Lt. Co. expects to purchase one 50-kw, 60-cycle alternating-current generator with exciter (not yet decided whether single or three-phase system will be used), 15 or 18 transformers (200 lamps to 12 lamps) and a car load of poles. J. C. Lee is owner and manager.

KILBOURNE, WIS.—The frequency changer in the municipal electric-light plant is being rewound, increasing the output of the plant from 85 kw to 110 kw. D. G. Howey is superintendent.

POYNETTE, WIS.—The Poynette El. Co., recently organized, has applied to the City Council for a franchise to construct and operate an electric-light and power plant. Perry E. Speed is president.

ROME, WIS.—The Bark River El. Lt. & Pwr. Co., of Rome, expects to extend its transmission lines to Helenville, 5 miles distant, this spring, and possibly to Palmyra, a distance of 8 miles. A. A. Lepper is superintendent.

BROOKSTON, MINN.—The City Council has passed an ordinance granting L. P. Runkle a franchise to construct and operate an electric-light and power plant in Brookston.

EVAN, MINN.—The contract for construction of an electric plant is reported to have been awarded to Johnson & Jensen.

HENDRUM, MINN.—Plans are being considered by the municipal authorities, it is reported, for the construction of a dam on Wild Rice Lake for the purpose of utilizing the power for an electric light and power plant.

MARSHALL, MINN.—Bids will be received by the city of Marshall at the office of A. A. Regnier, city clerk, until March 1 for one 100-kw alternating-current generator and engine (directly connected), two switchboard panels and other accessories. Specifications are on file in the office of the city clerk, Marshall, Minneapolis Builders' Exchange, Minneapolis, and at the office of W. C. Buck, consulting engineer, Minneapolis, Minn.

MILLVILLE, MINN.—The installation of a municipal electric-lighting plant in Millville is reported to be under consideration.

STAPLES, MINN.—The Board of Public Works expects, within the next few months, to purchase material for distribution and lighting system, including wire, transformers, hoods and poles for changing street-lighting system from multiple to series system. F. W. Finsden is secretary.

WINDOM, MINN.—Bids will be received by W. M. Hale, village recorder, Windom, until March 16 for construction of an electric-lighting plant for the village of Windom as follows: (1) Furnishing and erecting one 125-hp fire-tube boiler, breeching, piping connections, etc., one 75-kva and one 100-kva engine-driven generating unit, switchboard, etc.; (2) furnishing and erecting poles, wire, street lamps, transformers, etc., for electrical distribution system. Plans and specifications are on file in the office of the village recorder, Windom, and at the office of Earle D. Jackson, consulting engineer, Capitol Bank Building, St. Paul, Minn.

WORTHINGTON, MINN.—Within the next 12 months the Board of Public Works expects to purchase electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc., aggregating a total expenditure of about $5,000, for the Municipal Electric Light Department. W. H. Burchard is city clerk.

CLERMONT, IA.—Within the next six months C. Miller & Sons, owners of the local electric-light plant, expect to erect 10 miles of 13,000-volt single-phase transmission line; also a distribution system in a town of about 1200, and to purchase some transformers.

CRESTON, IA.—Within the next two months the Creston Mutual El. Lt., Ht. & Pwr. Co. expects to purchase three barometric condensers, cooling tower, etc., for its plant of 1000 hp. George E. Cornelius is manager.

SLOAN, IA.—Steps have been taken to organize a company to install and operate an electric-lighting plant in Sloan.

THORNTON, IA.—The installation of a municipal electric-lighting plant in Thornton is reported to be under consideration.

ALBANY, MO.—The city of Albany expects to extend the transmission lines of the municipal electric-lighting plant about 4 miles into the outlying districts to supply electrcity to farmers for lamps and motors. W. E. Noonan is manager.

BARNARD, MO.—The town of Barnard has granted a franchise to Oren Miller, of Barnard, to construct and operate an electric-lighting plant here; also a contract for street-lighting, which calls for 18 lamps. Machinery, it is understood, has been purchased.

BETHANY, MO.—Improvements are being made to the municipal electric-lighting plant, including the installation of a 200-kva Allis-Chalmers generator and engine, directly connected. J. F. Springer is superintendent.

CLARENCE, MO. — The city of Clarence has recently placed a contract for a 200-hp Allis-Chalmers engine and a 120-kw Allis-Chalmers generator (directly connected); also for one 50-hp Chuse engine to be directly connected to a 40-kw generator. It is expected to change the system entirely this summer. Don McIntire is superintendent.

HUME, MO.—The City Council has granted a franchise to Julian J. Ross, of Hannibal, to construct and operate an electric-light plant in Hume. An ice factory, it is understood, will be built in connection with the electric plant.

INDEPENDENCE, MO.—Plans are being considered for extending the municipal electric-lighting service to the Lexington Road district, a distance of about 1 mile.

KANSAS CITY, MO.—The Squire El. & Construction Co., of Kansas City, has been awarded the contract for the wiring and lighting fixtures for the new Cocacola Building (12 stories high).

SPRINGFIELD, MO. — The Springfield City Wtr. Co. is contemplating the purchase of pumping and electrical machinery to be used in connection with equipping the deep wells of the company with electrically operated pumps. R. L. Pate is manager.

WELLSVILLE, MO.—Plans are being considered for the construction of a municipal electric-lighting plant in Wellsville, for which bonds have already been voted.

CARPIO, N. D.—Plans are being considered for the installation of a municipal electric-lighting plant in Carpio.

COGSWELL, N. D.—The Cogswell El. Lt. & Pwr. Co. expects to purchase one engine and generator within the next six months. H. L. Taylor is secretary.

EPPING, N. D.—H. A. Gerling, of Epping, it is reported, is planning to install an electric-lighting plant.

HEBRON, N. D.—Within the next few months the Hebron El. Lt. & Pwr. Co. expects to purchase material, including poles, wire, cross-arms, etc. (small amount), for extensions to its system. The company is also contemplating establishing a day service. E. L. Carlton is secretary and manager.

LAKOTA, N. D.—Within the next three months the Lakota Lt. & Pwr. Co. expects to erect 1 mile of 1100-volt transmission line to supply electricity to farmers near this city. The company has recently installed one 100-hp high-pressure boiler and a 65-hp steam engine. James P. Larson is manager.

LIDGERWOOD, N. D.—Within the next eight months the Lidgerwood Mill Co. expects to purchase electrical supplies, a number of electrical ranges, vacuum cleaners, washing machines, etc.; also within the next 12 months to purchase incandescent lamps amounting to $300. W. R. Movins is president.

MILNOR, N. D.—The town of Milnor has granted a franchise to David Vail to install and operate an electric-lighting plant in Milnor.

MINOT, N. D.—The Northern Tel. Co., of Minot, expects to purchase within the next one or two months a motor-driven pump for the city water supply. C. H. Coar is general superintendent.

WOONSOCKET, S. D.—The Schuler El. Co., of Woonsocket, has recently remodeled its plant and installed steam engines. The company proposes to extend its transmission lines and supply electricity to six smaller towns this summer. A. G. Shuler is president and manager.

ADAMS, NEB.—Bids will be received by Charles Putney, village clerk, Adams, Neb., until March 12, for furnishing one oil engine, one generator, poles and material for construction of an electric-light plant, to cost about $4,000. For details see proposal columns.

DAVID CITY, NEB.—Within the next three months the city of David City expects to purchase one 100-hp boiler, one 150-hp to 250-hp Corliss engine and a 30-hp, 2300-volt motor, wire for line construction and other supplies for the municipal electric-light plant; also some vacuum cleaners, washing machines, etc. The city will also erect some new transmission lines. F. H. Harbican is manager.

EDGAR, NEB.—The City Council has called a special election to be held March 4 for the purpose of submitting the proposal

to issue $13,500 in bonds for the purpose of extending and remodeling the municipal electric-lighting plant.

McCOOK, NEB.—Within the next three or four months the McCook El. Co. expects to purchase one 115-120-hp four-valve engine. Alexander Speer is general superintendent.

OMAHA, NEB.—The Omaha & Lincoln Ry. & Lt. Co., of Omaha, is rebuilding its plant, material for which has already been purchased. The company has extended its service to six towns since Jan. 1, 1914. A. H. Huntington is superintendent.

BLUE RAPIDS, KAN.—The Marshall County Pwr. & Lt. Co., of Blue Rapids, has just completed the installation of two new Leffel waterwheels and two vertical-type General Electric generators of 150 kw each, with Lombard governor, General Electric switchboard, exciters, etc. The company will install a steam plant as soon as connections are made to adjoining towns. J. G. Strong is secretary and manager.

GRIDLEY, KAN.—Plans are being considered for the installation of an electric-lighting system in Gridley. Energy to operate the proposed system will probably be obtained from the Burlington Lt., Pwr. & Mfg. Co., of Burlington.

HAYS, KAN.—Plans are being considered for the installation of a municipal electric-light plant, to cost about $10,000.

LEAVENWORTH, KAN.—The contract for wiring and lighting fixtures for St. Mary's Academy, Leavenworth, is reported to have been awarded to the Squire El. & Construction Co., of Kansas City, at $15,000.

LYONS, KAN.—The Lyons El. & Mfg. Co. has placed a contract with the Westinghouse El. & Mfg. Co., of Pittsburgh, Pa., for a 125-kw, three-phase, 60-cycle, 2400-volt generator, which will be directly connected to a 225-hp engine.

OSAWATOMIE, KAN.—Plans are being considered for remodeling the municipal electric-lighting plant, bids for which will soon be called for.

POMONA, KAN.—Plans are being considered to install an electric-lighting system in Pomona. It is proposed to secure electricity to operate the system from the electric plant in Ottawa. The project involves the erection of a transmission line between Pomona and Ottawa. An election will be held to submit to the voters the proposal to issue $10,000 in bonds to build the plant and transmission line.

POWHATTAN, KAN.—The Council is contemplating calling an election to submit to the voters the proposal to issue $10,000 in bonds for the installation of a municipal electric-lighting plant in Powhattan.

SALINA, KAN.—The Salina Lt., Pwr. & Gas Co. is reported to be contemplating improvements to its plant during 1915, to cost about $40,000. The present plans provide for addition to power station, installation of boilers and generating equipment, etc.

WELLINGTON, KAN.—The City Commissioners have awarded the contract for equipment, including engines, generators, etc., for the new municipal electric plant to the Westinghouse El. & Mfg. Co., of Pittsburgh, Pa., at $30,700.

WINFIELD, KAN.—Arrangements, it is reported, are being made by the Broken Arrow Lt. & Pwr. Co., of Winfield, to increase the output of its plant. Contracts have been placed for a 125-kw alternator and switchboard. The generator will be directly connected to a Skinner engine.

Southern States

LOUISBURG, N. C.—Within the next two months the manager of the municipal electric-light plant expects to purchase about 100 poles. R. C. Beck is superintendent.

WILSON, N. C.—The city of Wilson has petitioned the State Legislature for authority to issue $80,000 in bonds, the proceeds to be used to rebuild the municipal electric-light plant.

CORDELLE, GA.—The City Council is considering calling an election to submit to the voters the proposal to issue bonds for a municipal electric-lighting plant.

DARIEN, GA.—The Darien Mfg. Co. has taken over the property of the Darien Ice & Lt. Co. and is moving the plants to the river front. Slabs and sawdust from the sawmill will be used for fuel. Charles M. Tyson is president.

HAWKINSVILLE, GA.—The city of Hawkinsville has placed an order for a four-valve Harrisburg engine to be directly connected to a 75-kva generator, which will be installed within 90 days; also for a 25-hp, three-phase, 2300-volt motor connected to a Platt Iron Works three-stage, 170-ft.-head centrifugal pump to lift 250 gal. per minute. E. L. Wilson is general superintendent.

MOULTRIE, GA.—The city of Moultrie is now installing an ornamental lighting system, consisting of 100 standards carrying five-lamp clusters. The generating capacity of the municipal electric-light plant has recently been doubled; additional boilers will probably have to be installed during the year. J. M. George is superintendent.

CLARKSVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 22 for new toilet room, lighting fixtures, etc., in the United States post office, Clarksville, Tenn. For details see proposal columns. O. Wenderoth is supervising architect.

TAZEWELL, TENN.—The installation of an electric-light plant in Tazewell is reported to be under consideration.

BAY MINETTE, ALA.—The city of Bay Minette has awarded the contract for the construction of an electric-lighting plant, water-works and sewer system to the Sullivan, Long & Haggerty Co., of Bessemer. The equipment of the electric plant will include one 50-kva. three-phase, 2300-volt generator, two-panel switchboard, exciter and about 2 miles of pole line.

ACKERMAN, MISS.—The city of Ackerman expects to erect within the next six months a three-phase transmission line to pumping station, 2 miles distant; also to purchase a pump and 10-hp motor for pumping water from a 50,000-gal. concrete reservoir (yet to be constructed), and material for the above transmission line. A. J. Collins is superintendent.

BROOKHAVEN, MISS.—Within the next two or three months a small quantity of line construction material for ordinary repairs for the municipal electric-light system will be purchased. R. S. Purser is superintendent.

CLARKSDALE, MISS.—Within the next six months the city of Clarksdale expects to purchase a new boiler, turbine and generator. W. S. Bobo is general superintendent.

GREENVILLE, MISS.—Bids will be received by J. E. Leppert, chairman building committee, Greenville, Miss., until March 15, for construction of a high school building in Greenville, including heating, plumbing and wiring. Plans and specifications may be obtained upon application to R. H. Hunt, architect, Chattanooga, Tenn., for which a deposit of $25 will be required, to be refunded upon return of same.

RUSSELLVILLE, ARK.—Application has been made to the City Council by Edward H. Crow, of St. Louis, Mo., for a franchise to supply electricity in Russellville for a period of 40 years.

BASTROP, LA.—Bonds to the amount of $16,000 have been voted for improvements to the municipal electric-light plant and water-works system.

FREDERICK, OKLA.—The Foster-Harris Gin & El. Co., of Frederick, which owns the local electric plant, has purchased from the Westinghouse El. & Mfg. Co., of Pittsburgh, Pa., a 250-kw generator (belted), which will replace a 75-kw machine.

ABILENE, TEX.—Improvements are being made to the plant of the Abilene Gas & El. Co., including the installation of two 400-hp water-tube boilers and one 500-kw turbo-generator, with switchboard for generator and exciters. Contracts for the work have been awarded. A. V. Wainwright is vice-president.

HENDERSON, TEX.—The Henderson Cotton Oil & Gin Co., which furnishes electricity at both flat and meter rate, is contemplating the purchase of 200 meters and discontinuing the flat-rate service. O. E. Morris is superintendent.

SOMERVILLE, TEX.—The Somerville Ice Co. has purchased the local electric-light plant. It is understood that improvements will be made to the property.

VICTORIA, TEX.—The Texas Southern El. Co., of Victoria, is erecting a 23,000-volt, three-phase transmission line between Victoria and Cuero, a distance of 31 miles. W. B. Du Pre is general manager.

Pacific States

ELLENSBURG, WASH.—The city of Ellensburg expects to build a new concrete forebay and a new power house. The machinery now in use will be removed to the new station and a new 325-hp boiler and a 1000-kw steam turbine will also be installed. E. T. Butler is manager.

EVERETT, WASH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 22, for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Everett, Wash. Specifications may be obtained from the above office or the custodian of site at Everett. O. Wenderoth is supervising architect.

GRANITE FALLS, WASH. — C. H. Cleaver, manager of the Granite Falls El. Co., is making investigations for the electrolytic manufacture of oxygen and would like to receive catalogs and prices on apparatus for same.

SEATTLE, WASH.—The Board of Public Works has recently granted the Puget Sound Trac., Lt. & Pwr. Co., of Seattle, permission to erect transmission lines on West Forty-first Street, Sixth Avenue Northwest and West Sixtieth Street.

OAK PARK, CAL.—Steps have been taken by the Oak Park Business Men's Association to secure an electrolier lighting system in the business district of the city.

PORTERVILLE, CAL. — The Business Men's Association has appointed a committee to take up with the property owners in the business district the proposal to install an electrolier lighting system in the business section of the city.

KELLOGG, IDAHO.—Within the next five months the Bunker Hill & Sullivan Mining & Construction Co., of Kellogg, expects to purchase insulators, underground cable, wire, meters and lamp-posts. Walter C. Clark is superintendent.

SALT LAKE CITY, UTAH.—A bill has been introduced by Senator Eckersley into the Utah Legislature for the creation of special lighting improvement districts, under which property owners on any street or subdivision may petition the City Commission to create special lighting improvement districts to install lighting systems, the cost to be assessed against the property benefited. It is believed that if this bill passes th Legislature and is approved by the Governor, at least 6 or 7 miles of special street-lighting systems will be installed in Salt Lake City and Ogden early in the spring.

FLORENCE, ARIZ.—A movement has been started for the erection of an electric transmission line from Florence to Sacaton. The matter has been referred to the board of governors of the water association at Phoenix. It is proposed to supply electricity to ranchers along the line as well as in Sacaton.

TOMBSTONE, ARIZ. — Steps will be taken immediately by the City Council to make investigations and secure estimates of the cost of the installation of a municipal electric-lighting plant in Tombstone.

CHOTEAU, MONT.—The Montana Pwr. Co., of Butte, it is reported, will extend its transmission lines to Choteau, work to begin as soon as the weather permits.

GLASGOW, MONT.—Extensive improvements will be made to the municipal electric-lighting system this spring, including the construction of a new power house, the erection of a brick smokestack and the installation of a 225-hp four-valve engine, one 200-hp water-tube boiler and a 150-kw generator. H. J. Hughes is superintendent and purchasing agent.

CASPER, WYO.—The Natrona County El. Co., of Casper, expects to install a 400-kw generating unit this summer. Two new Erie City water-tube boilers of 250 hp each are now being installed. J. A. Ward is general manager.

DENVER, COL.—The Colorado Pwr. Co., of Denver, it is reported, is contemplating the installation of an auxiliary steam-power plant near Denver.

LAS CRUCES, N. M.—The Las Cruces El. Lt. & Ice Co. expects to purchase a 250-hp Diesel-engine-driven unit within the next few months. D. W. Morgan is manager.

Canada

WINNIPEG, MAN.—An additional 5000-kva Westinghouse generator and an Escher & Wyss water turbine are being installed in the municipal electric plant at Point du Bois; two 6000-kv$_A$ synchronous condensers are also being installed in the city station to take care of the line regulation. E. V. Caton is chief engineer.

DUTTON, ONT.—The Town Council, it is reported, will ask for bids in the spring for electrical equipment, to include transformers, switches, etc., to cost about $15,000.

WALLACEBURG, ONT.—The electric plant owned by the Wallaceburg Cas Co. has been taken over by the municipality. The purchase price was $36,975. W. R. Waghorne, superintendent of the company, retains the same position with the town.

Weekly Record of Electrical Patents

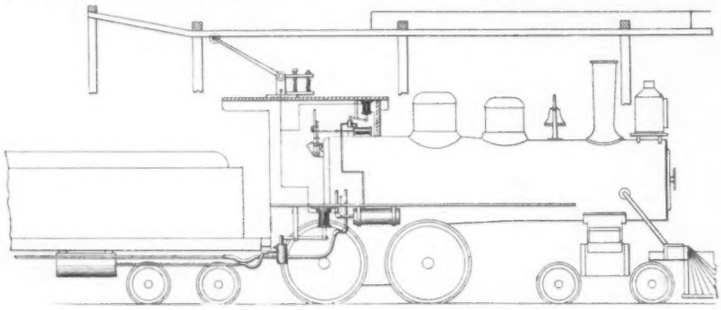
UNITED STATES PATENTS ISSUED FEBRUARY 16, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,128,279. Electric-Wave Amplifier; H. De F. Arnold, East Orange, N. J. App. filed May 16, 1914. Employs two andiron elements.

1,128,280. Thermionic Detector; H. De F. Arnold, East Orange, N. J. App. filed June 8, 1914. Andiron with pair of input electrodes similarly connected to negative pole of local input circuit and oppositely connected to the source of current to be detected.

1,128,292. Electric-Wave Amplifier; E. H. Colpitts, East Orange, N. J. App. filed Jan. 3, 1914. One andiron repeats positive parts and other andiron repeats negative parts of the input waves.



1,128,932—Automatic Train Stop

1,128,313. Process of Separating Copper from Nickel and Matte and Other Products; N. V. Hybinette, Christiansand, Norway. App. filed June 5, 1912. Copper-nickel matte slab subjected to electrolytic action as an anode.

1,128,315. Process of Circulating Solution for Electrolysis; N. V. Hybinette, Christiania, Norway. App. filed June 5, 1912. Electrolyte passed alternately into the bottom and top of the cathode compartment.

1,128,316. Anode for Electrolysis; N. V. Hybinette, Christiania, Norway. App. filed June 5, 1912. Nickel, copper and sulphur with an electrolytically treated surface.

1,128,366. Electrical Heating Device; E. H. Ruckle, Chicago, Ill. App. filed June 10, 1914. Hot-plate for use on electrical stoves.

1,128,383. Single-Spark Apparatus for Internal-Combustion Engines; E. W. Stevens, Baltimore, Md. App. filed Aug. 31, 1914. Solenoid for holding open the main contacts.

1,128,405. Testing Apparatus for Meters; L. R. Brooks, Pittsburgh, Pa. App. filed Aug. 17, 1912. Permits testing without interfering with the customer's service.

1,128,422. Printing Telegraph Receiver; A. F. Dixon, Newark, N. J. App. filed March 19, 1914. One selection of the rotating-current distributer can be retained while another selection is being prepared.

1,128,424. Insulator; J. D. E. Duncan (deceased), East Orange, N. J. App. filed Sept. 9, 1907. Compound; high-tension.

1,128,427. Method of Treating Molds Used in the Art of Electrotyping; G. E. Dunton, New York, N. Y. App. filed June 23, 1914. Insulating the mold from its molding pan.

1,128,439. Signal-Controlling Means for Railway Gates; J. A. Gasse, Claremont, N. H. App. filed Sept. 12, 1911. Attached to gate and thrown into and out of operation by the lowering and raising of the gate.

1,128,469. Automatic Telephone Exchange; G. W. Lorimer, Piqua, Ohio. App. filed May 31, 1906. Division starter.

1,128,481. Amalgamating or Plating Machine; C. G. Miller, Chicago, Ill. App. filed July 17, 1912. For plating or galvanizing structural bars continuously and progressively.

1,128,492. Telautographic Apparatus; H. W. O'Neill, Brooklyn, N. Y. App. filed Feb. 24, 1912. Short-circuiting buzzer for vibrating the pen-moving parts.

1,128,493. Telautographic Apparatus; H. W. O'Neill, Brooklyn, N. Y. App. filed March 7, 1912. Condenser through alternating-current waves vibrates the pen-moving parts.

1,128,498. Safety Apparatus for Railway Systems; A. Pecorella, Buffalo, N. Y. App. filed Oct. 6, 1914. Includes contact rails along the tracks.

1,128,515. Welding Piece for Electrically Welded Metal Work; A. F. Rietzel, Charlestown, R. I. App. filed Sept. 16, 1909. Welding blank of tapered construction.

1,128,552. Detector; F. B. Turner, Huntington Beach, Cal. App. filed June 4, 1914. Contact member adjustable for engagement with any one of a number of crystal masses.

1,128,554. Electric Heater; W. B. Underwood, Erie, Pa. App. filed Jan. 30, 1914. Pressure contact effected between the resistor and lead.

1,128,562. Electromagnet; H. G. Webster, Chicago, Ill. App. filed Sept. 28, 1907. Differential; for telephone work.

1,128,568. Railway Switch or the Like; C. O. Anderson, Omaha, Neb. App. filed March 29, 1909. Self-adjusting; electrically operated.

1,128,570. Railway Switch-Operating Mechanism or the Like; W. A. Austin, Omaha, Neb. App. filed Oct. 16, 1909. Actuating motor arranged wherever convenient.

1,128,582. Automatic Stop; V. H. Carman, Indianapolis, Ind. App. filed Aug. 4, 1913. For stopping switch at an intermediate point; star-delta switch.

1,128,600. Electrical Type Telegraph; F. C. Grasme, Hoboken, N. J. App. filed March 19, 1914. Stock ticker.

1,128,640. Electric Furnace and Process of Heating Substances Uniformly and at a Controllable Temperature; E. F. Von Wilmowsky (deceased), Boston, Mass. App. filed Oct. 28, 1896. Heats substances uniformly and continuously at controllable temperature in an electric arc.

1,128,644. Lighter for Gas Stoves; T. L. Wiese, Milwaukee, Wis. App. filed April 14, 1913. Igniting burner opened and lighted by single act of pressing button.

1,128,646. Telephone-Exchange System; J. L. Wright, Washington, D. C. App. filed March 8, 1912. Improved means controlling the signal circuit during the establishment and completion of a connection.

1,128,660. Call-Distributing Telephone System; H. P. Clausen, Rochester, N. Y. App. filed June 26, 1911. Has means for counting the calls received by the various operators.

1,128,690. Electric Riveting Machine; C. Knoth, Newark, N. J. App. filed Sept. 26, 1914. Improved means for heating the heads of rivets while pressing the heads upon the parts which they connect.

1,128,692. Motor Controller; C. J. Kruse, Cleveland, Ohio. App. filed Jan. 5, 1911. For causing motor to give "kick-off" to its load and for protecting motor after dynamic braking circuit has been established.

1,128,701. Central-Station Switch Apparatus for Automatic Telephone Systems; F. A. Linquist and J. J. Brownrigg, Chicago, Ill. App. filed May 19, 1903. Calling subscriber receives a "busy" signal which does not disturb the called subscriber.

1,128,731. Electric-Heating Device; E. B. Spencer, Kenmore, N. Y. App. filed April 30, 1914. For heating and expanding automobile rims, wagon tires, etc.

1,128,744. Push-Button; W. W. Barcy, Jr., Detroit, Mich. App. filed March 7, 1914. All the elements can be assembled before the switch is applied to the wall.

1,128,746. Creeper; F. N. Bierce, Cincinnati, Ohio. App. filed Jan. 13, 1914. For threading a line through conduit; special toggle construction.

1,128,747. Method of Manufacturing Porcelain Insulators; W. Boehm, Charlottenburg, Germany, App. filed Feb. 24, 1913. Fills pores with insulating compound and exposes to the action of ozone.

1,128,764. Fuse; E. G. Davis, Paris Crossing, Ind. App. filed May 4, 1914. Detachable end-cap construction.

1,128,777. Telephone System; C. E. Hague, Rochester, N. Y. App. filed April 22, 1910. Call-distributing system.

1,128,817. Valve Detector for Wireless; G. W. Pickard, Amesbury, Mass. App. filed July 3, 1912. Prevents interruptions due to the building up of static charges.

1,128,842. Conduit Clamping Plate and Disk; W. A. Bonnell, Brooklyn, N. Y. App. filed June 23, 1913. Armored cable clamping plate with knock-out disk integral therewith.

1,128,857. Selective Signaling System for Party Lines; E. B. Craft, Hackensack, N. J. App. filed June 29, 1910. Train dispatching.

1,128,905. Agitating Electric Amalgamator; L. St. D. Roylance, San Francisco, Cal. App. filed Nov. 14, 1913. Bearings positively protected from contact with the solution.

1,128,914. Magneto Electric Generator; C. A. Stone and G. C. Brown, Buffalo, N. Y. App. filed Sept. 8, 1908. Armature has a primary and a secondary winding thereon.

1,128,927. Telephone Repeating Device; D. H. Wilson, New York, N. Y. App. filed April 11, 1913. Repeater is used upon a grounded circuit.

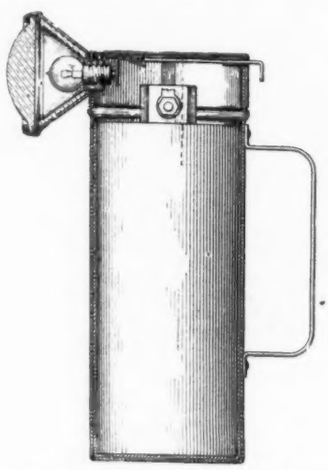
1,128,930. Telephone System; F. V. Young, Lyndhurst, N. J. App. filed June 19, 1914. Improved signal-controlling means.

1,128,932. Automatic Train Stop; F. G. Bastian, Buffalo, N. Y. App. filed Jan. 22, 1913. Controlled by trolley, special brake and throttle control.

1,128,943. Telephone Relay; S. G. Brown, London, England. App. filed Jan. 3, 1912. Highly sensitive variable resistance for inclusion in local circuit.

1,128,944. Electrical Relay; S. G. Brown, London, England. App. filed Jan. 3, 1912. For wireless work or long telephone lines.

1,128,945. Portable Electric Lamp; J. J. Brownrigg, H. Henderson and A. E. Case, Marion, Ind. App. filed Feb. 6, 1914. Takes an ordinary dry cell.



1,128,945—Portable Electric Lamp

1,128,956. Apparatus for Handling Electric Connector or Tapping Devices; J. M. Downs, Savannah, Ga. App. filed March 9, 1914. For applying spring connectors to high-tension wires and removing same therefrom with safety.

1,128,966. Process of Making Peroxide of Hydrogen; F. Fischer, Charlottenburg, Germany. App. filed May 7, 1913. Electrolysis carried out at pressure above atmospheric.

1,128,978. Timer; F. C. Hersee, Roslindale, Mass. App. filed July 13, 1914. Has relatively stationary contacts in the form of spring-pressed balls.

1,129,036. Electric Motor; E. G. Hoffmann (deceased), New Rochelle, N. Y. App. filed July 27, 1907. Special construction; for propulsion of motor vehicles.

1,129,051. Liquid-Level Register and Alarm; M. G. Crooks, Evansville, Ind. App. filed March 20, 1914. For automobiles; sounds alarm when predetermined low point is reached.